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Comprehensive Emissions Test Report

3M Health Care
Ethylene Oxide Destruction Efficiency
Compliance Testing

Testing Date(s): April 23, 2019
Report Date: June 5, 2019
Revision Date: No revision to date

Subject Facility:

3M Health Care
601 22nd Avenue S
Brookings, SD 57006

Regulatory Permit No.:
28.9901-06

Subject Emission Sources:
Ethylene Oxide Abator

Test Locations:
Thermal Oxidizer Inlet
Thermal Oxidizer Outlet

Report Prepared For:

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Pace Project No. 19-01569B
3M LIMS E19-0099

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Regulatory Summary

Subject Facility: 3M Health Care
Plant Address: 601 22nd Avenue S
Brookings, SD 57006

Air Permit No.: 28.9901-06

Emission Unit IDs	Emission Unit Name	Regulated Constituent	Regulatory Citations	Regulatory Limit	Average Test Result
Unit 13b	Ethylene Oxide Abator Catalytic Thermal Oxidizer	Ethylene Oxide	40 CFR 63 Subpart O (Ethylene Oxide Emission Standards for Sterilization Facilities)	≥99.0% destruction efficiency	≥99.8%

Introduction

Pace Analytical Services, LLC personnel conducted ethylene oxide destruction efficiency testing on the Ethylene Oxide Abator Thermal Oxidizer at the 3M Health Care facility located in Brookings, South Dakota. Brett Erickson and Daniel Luoma performed on-site testing activities on April 23, 2019. Brett Erickson provided administrative project management. Paul Peterson with 3M Health Care coordinated plant activities during testing. Pace Analytical Services, LLC prepared a comprehensive test protocol that was submitted to the South Dakota Department of Environment and Natural Resources (SDDENR) prior to testing. Compliance testing consisted of the following measurements at the inlet and outlet of the Ethylene Oxide Abator Catalytic Thermal Oxidizer:

- Ethylene oxide and water vapor, three independent one-hour monitoring periods.
- Volumetric airflow, continuous tracer gas measurement concurrent with above.
- Volumetric airflow, measurements once each constituent test run at the outlet only.

The project objectives were to quantify ethylene oxide loading and emission constituents for destruction efficiency calculation and comparison to applicable air emissions regulations stipulated by SDDENR and the facility permit. These measurements were performed at normal operation conditions. Quality protocols comply with regulatory compliance testing requirements.

Subsequent sections summarize the test results and provide descriptions of the process and test methods. Supporting information and raw data are in the appendices.

Results Summary

Results of ethylene oxide determinations are summarized in Table 1 and detailed in Tables 2 and 3. The ethylene oxide loading rate averaged 0.402 LB/HR at 1,966 PPMv-wet. The ethylene oxide emission rate averaged ≤0.00098 LB/HR at ≤0.75 PPMv-wet. The resulting destruction efficiency is ≥99.8%. The ethylene oxide destruction efficiency limit for this source is ≥99.0%.

Airflow determinations for both inlet and stack were made by OTM-24 and are detailed in Tables 4 and 5. Table 6 details the airflow measurements following EPA Method 2 and Table 7 details vane anemometer measurements. It was determined onsite that the differential pressure of the stack was too low for accurate measurement using EPA Method 2 (digital manometer readings <0.001 for most traverse points) so vane anemometer readings were collected at each traverse point in addition to differential pressures. The results based on these two methods were quite variable. Because sulfur hexafluoride is not expected to be destroyed/reduced at the temperature of this thermal oxidizer, OTM-24 can be used to calculate the outlet airflow. Airflow results from OTM-24 determinations are much more consistent than the other methods and are used to calculate ethylene oxide mass rate for both the inlet and stack of the Ethylene Oxide Abator Catalytic Thermal Oxidizer.

Ethylene oxide spiked to very high concentrations once per test run so the inlet gas stream was diluted with ethylene for a portion of each run. During the spike of high concentration ethylene oxide, the sulfur hexafluoride (SF_6) became unquantifiable due to spectral interference from the ethylene oxide. The 2-4 minutes of data affected by this were excluded from the SF_6 run average and are highlighted in red in the Appendix B FTIR Monitoring Log.

Ethylene oxide was detected on the Ethylene Oxide Abator Catalytic Thermal Oxidizer Stack a minimum of 1 minute each run. Dynamic matrix spiking was performed and

spike recovery averaged 92.4%. Subsequent appendices provide expanded detail of test results.

The data in this report are indicative of emission characteristics of the measured sources for process conditions at the time of the test. Representations to other sources and test conditions are beyond the scope of this report.

Summary Table

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Table 1

Speciated Constituent (M320) DRE Summary
Ethylene Oxide Abator Catalytic Thermal Oxidizer
Test 1

Parameter	Run 1	Run 2	Run 3	Average
Date of Run	4/23/19	4/23/19	4/23/19	
Inlet Measurements				
Volumetric Flow Rate (Rounded to 0.1 CFM)				
SCFM	31.6	29.6	28.7	30.0
DSCFM	31.6	29.5	28.6	29.9
Constituent Mass Rate, LB/HR				
Ethylene Oxide	0.362	0.385	0.458	0.402
Outlet Measurements				
Volumetric Flow Rate (Rounded to 1 CFM)				
ACFM	259	249	255	254
SCFM	193	189	189	190
DSCFM	191	187	188	189
Constituent Mass Rate, LB/HR				
Ethylene Oxide	≤0.00099	≤0.00097	≤0.00097	≤0.00098
DRE for Ethylene Oxide	≥99.7%	≥99.7%	≥99.8%	≥99.8%

Detail Tables

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Table 2

Speciated Constituent (M320) Results
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

Parameter	**Run 1**	**Run 2**	**Run 3**	**Average**
Date of Run	4/23/19	4/23/19	4/23/19	
Time of Run	0858-1101	1129-1322	1348-1532	
Sample Duration (Minutes)	124	113	105	
Duct Moisture Content (%v/v)	0.2	0.2	0.2	0.2
Volumetric Flow Rate (Rounded to 0.1 CFM)				
SCFM	31.6	29.6	28.7	30.0
DSCFM	31.6	29.5	28.6	29.9
Constituent Concentration, PPMv - Wet				
Ethylene Oxide	1,667	1,900	2,331	1,966
Sulfur Hexafluoride	0.355	0.380	0.391	0.375
Constituent Concentration, PPMv - Dry				
Ethylene Oxide	1,670	1,904	2,335	1,970
Sulfur Hexafluoride	0.355	0.380	0.392	0.376
Constituent Mass Rate, LB/HR				
Ethylene Oxide	0.362	0.385	0.458	0.402
Sulfur Hexafluoride	0.000255	0.000255	0.000255	0.000255

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Table 3

Speciated Constituent (M320) Results
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

Parameter	Run 1	Run 2	Run 3	Average
Date of Run	4/23/19	4/23/19	4/23/19	
Time of Run	0857-1102	1130-1321	1347-1533	
Sample Duration (Minutes)	126	111	107	
Stack Temperature (°F)	214	201	216	210
Duct Moisture Content (%v/v)	0.9	0.9	0.9	0.9
Volumetric Flow Rate (Rounded to 1 CFM)				
ACFM	259	249	255	254
SCFM	193	189	189	190
DSCFM	191	187	188	189
Constituent Concentration, PPMv - Wet				
Ethylene Oxide	≤0.75	≤0.75	≤0.75	≤0.75
Sulfur Hexafluoride	0.0581	0.0592	0.0591	0.0588
Constituent Concentration, PPMv - Dry				
Ethylene Oxide	≤0.76	≤0.76	≤0.76	≤0.76
Sulfur Hexafluoride	0.0587	0.0597	0.0596	0.0593
Constituent Mass Rate, LB/HR				
Ethylene Oxide	≤0.00099	≤0.00097	≤0.00097	≤0.00098
Sulfur Hexafluoride	0.000255	0.000254	0.000255	0.000254

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Table 4

OTM 24 Calculations
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

Parameter	**Run 1**	**Run 2**	**Run 3**	**Average**
Date of Run	4/23/19	4/23/19	4/23/19	
Time of Run	0858-1101	1129-1322	1348-1532	
Sample Duration (Minutes)	124	113	105	
Tracer Gas Flow				
LPM	0.318	0.318	0.318	0.318
DSCFM	0.01123	0.01123	0.01123	0.01123
Injected Concentration, PPMv - Dry				
Sulfur Hexafluoride	1,000	1,000	1,000	1,000
Recovered Concentration, PPMv - Dry				
DF Corrected Sulfur Hexafluorid	0.355	0.380	0.392	0.376
Dilution Factor	2,814	2,629	2,549	2,659
Volumetric Flow				
Total Gas Flow, DSCFM	31.6	29.5	28.6	29.9
Flue Gas Flow, DSCFM	31.6	29.5	28.6	29.9

Dilution Factor (DF) = Injected Concentration / Recovered Concentration

Total Gas Flow = DF x Tracer Gas Flow, DSCFM

Flue Gas Flow = Total Flow, DSCFM - Tracer Gas Flow, DSCFM

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Table 5

Airflow Measurement Results - OTM 24
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

Parameter	Run 1	Run 2	Run 3	Average
Date of Run	4/23/19	4/23/19	4/23/19	
Time of Run	0857-1102	1130-1321	1347-1533	
Sample Duration (Minutes)	126	111	107	
Tracer Gas Flow				
LPM	0.318	0.318	0.318	0.318
DSCFM	0.0112	0.0112	0.0112	0.0112
Injected Concentration, PPMv - Dry				
Sulfur Hexafluoride	1,000	1,000	1,000	1,000
Recovered Concentration, PPMv - Dry				
Sulfur Hexafluoride	0.0587	0.0597	0.0593	0.0593
Dilution Factor	17,041	16,741	16,850	16,876
Volumetric Flow				
Total Gas Flow, DSCFM	191	188	189	190
Flue Gas Flow, DSCFM	191	188	189	190
Stack Temperature (°F)	214	201	216	210
Duct Moisture Content (%v/v) EPA Method 320	0.95	0.93	0.87	0.92
Absolute Gas Pressure (In. Hg)	28.40	28.40	28.40	28.40
Volumetric Flow Rate				
ACFM	260	250	257	256
SCFM	193	190	191	191
DSCFM	191	188	189	190

LPM = SLPM = DSLPM for injected tracer gas

DSCFM = LPM / 28.31685 L per CF

Dilution Factor (DF) = Injected Concentration / Recovered Concentration

Total Gas Flow = DF x Tracer Gas Flow, DSCFM

Flue Gas Flow = Total Flow, DSCFM - Tracer Gas Flow, DSCFM

SCFM = DSCFM / (1-H2O%)

ACFM = (Stack Temp, °R x (SCFM / 17.647)) / absolute gas pressure

Table 6

Airflow Measurement Results - EPA Method 2
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

Parameter	**Run 1**	**Run 2**	**Run 3**
Date of Run	4/23/19	4/23/19	4/23/19
Time of Measurement	1000	1200	1430
Barometric Pressure, Inches Hg	28.40	28.40	28.40
Static Pressure, Inches WC	-0.04	-0.05	-0.06
Absolute Gas Pressure (In. Hg)	28.40	28.40	28.40
Average Gas Temperature, °F	214	201	216
Moisture Determination Proc.: Psychrometric			
Average Moisture Content, %v/v	1.1	1.6	2.4
Gas Molecular Weight (Ambient), lb/lb-mole			
Dry	29.00	29.00	29.00
Wet	28.88	28.83	28.74
Flue Gas Average Velocity, FPS	0.31	1.07	1.06
Duct Cross-sectional Area, Sq. Ft.	4.67	4.67	4.67
Volumetric Flow Rate (Rounded to 1 CFM)			
ACFM	87	300	298
SCFM	65	228	221
DSCFM	64	224	216

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Table 7

Airflow Measurement Results - Vane Anemometer
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

Parameter	**Run 1**	**Run 2**	**Run 3**
Date of Run	4/23/19	4/23/19	4/23/19
Time of Measurement	1000	1200	1430
Barometric Pressure, Inches Hg	28.40	28.40	28.40
Static Pressure, Inches WC	-0.04	-0.05	-0.06
Absolute Gas Pressure (In. Hg)	28.40	28.40	28.40
Average Gas Temperature, °F	214	201	216
Moisture Determination Proc.: Psychrometric			
Average Moisture Content, %v/v	1.1	1.6	2.4
Gas Molecular Weight (Ambient), lb/lb-mole			
Dry	29.00	29.00	29.00
Wet	28.88	28.83	28.74
Flue Gas Average Velocity, FPS	0.67	0.32	0.32
Duct Cross-sectional Area, Sq. Ft.	4.67	4.67	4.67
Volumetric Flow Rate (Rounded to 1 CFM)			
ACFM	187	90	91
SCFM	139	69	67
DSCFM	137	67	66

Process Description

3M Health Care uses three ethylene oxide sterilizers to conduct product assurance testing of medical appliance products manufactured on site. Each sterilizer unit uses a small 100-gram canister of ethylene oxide gas to conduct batch quality testing. Each sterilizer runs independently of each other and conducts gas exposure testing cycles using various amounts of ethylene oxide gas from the canister. The only time ethylene oxide gas is released from a sterilizer is at the completion of a test cycle, followed by flushing of the sterilizer chamber with fresh air. The three sterilizers are all connected to a common manifold that transfers the gas to the catalytic thermal oxidizer outside of the building. For testing purposes, each run consisted of all three sterilizers using an entire can of ethylene oxide and venting simultaneously. All of the process piping is 2-inches in diameter or smaller and is constructed from stainless steel.

Each sterilizer is a batch process where the product is exposed to the ethylene oxide as part of the sterilization process. Ethylene oxide is released when the cycles complete and gas is flushed out of the sterilizer to the Ethylene Oxide Abator Thermal Oxidizer. The catalyst bed inlet temperature set-point was 360°F for all three runs. Detailed oxidizer temperature logs and calculated ethylene oxide usage data are included in Appendix E.

Test Procedures

EPA Method 1 specifies test location acceptability criteria and defines the minimum number of traverse points for representative sampling. Linear measurements from upstream and downstream flow disturbances and the duct equivalent diameter are compared and the distances related to number of diameters. A flow disturbance can be defined as anything that changes or upsets the direction of flow within the duct including bends, dampers, fans, shape or size transitions, and open flames. Method 1 stipulates that test ports should be located at least eight diameters downstream and two diameters upstream of any flow disturbance. The minimum acceptable criteria are two diameters downstream and 0.5 diameters upstream of flow disturbances. The test location must also be free of cyclonic or multidirectional flow. Once the distances have been determined, the values are used to select the minimum number of traverse points for representative sampling. Shorter distances require a greater number of traverse points. The test site configuration and measurement details are documented on EPA Method 1 Field Data Sheet.

Pace FSD conducts the method as written with no routine deviations.

EPA Method 2 defines procedures used to measure linear velocity and volumetric flow rate of a confined gas stream. Using traverse points determined by EPA Method 1, multiple differential pressure measurements (pitot impact opening versus static pressure) are made using a pitot tube and differential pressure gauge. The individual measurements are averaged and combined with the gas density to calculate the average gas velocity. The velocity and duct cross-sectional area are used to calculate the volumetric flow rate. The volumetric flow rate is expressed as actual cubic feet per minute (ACFM), standard cubic feet per minute (SCFM), and dry standard cubic feet per minute (DSCFM). The technician maintains comprehensive test records on EPA Method 2 Field Data Sheet. Details of the equipment used to measure gas velocity include:

Pitot Tube:	S-Type, Vane Anemometer
Differential Pressure Gauge:	Electronic Digital Manometer
Temperature Device:	Type K Thermocouple
Barometer Type:	Electronic Digital Barometer
Gas Density Determination:	EPA Method 3 (ambient)
Gas Moisture Determination:	EPA Method 320

Method Defined Quality Control:

- Pitot tubes are verified on an annual basis.
- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.
- Electronic barometers are verified for accuracy and calibrated on a semi-annual basis. Aneroid barometers are not used.

- Electronic Digital Manometers (EDMs) are verified for accuracy and calibrated on a semi-annual basis. EDMs are operationally confirmed and leak checked for each run.
- Sampling system leak-checks are performed before and after each run and prior to any component change during a run.

Pace FSD conducted this method with the following project situational deviations:
Airflow measurements were only conducted at the outlet of the oxidizer due to safety concerns with high ethylene oxide concentrations on the inlet of the oxidizer.
-Low gas velocity resulted in very low differential pressure so direct velocity measurement by vane anemometer was conducted in conjunction with differential pressure measurements.

EPA Method 3 Ambient Provision allows the use of published or ambient gas concentrations (dry molecular weight of 28.96 LB/LB-mole) in cases where the source gas is free of combustion components. Ambient gas concentrations result in a dry molecular weight of 28.96 (29.0) LB/LB-mole.

Gas Constituent	% v/v	Molecular Weight	LB/LB -mole
Nitrogen, N_2	78.08	28.01	21.87
Oxygen, O_2	20.95	32	6.70
Argon, Ar	0.93	39.95	0.37
Carbon Dioxide, CO_2	0.038	44.01	0.02
Sum of Gas Constituents			28.96

Pace FSD conducted this method with the following project situational deviations:
Grab samples (integrated over approximately 5 minutes) were collected each run and verified to be ambient oxygen concentration with a portable oxygen meter.

Psychrometric Moisture Determination (EPA Method 4 Alternative Provision) defines procedures to measure the moisture content of emissions gas streams from stationary sources. Wet bulb/dry bulb temperature measurements of the gas stream are recorded. Psychrometric charts and vapor pressure of water tables are used to calculate the moisture content of the gas streams.

Method Defined Quality Control:

- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.

Pace FSD conducted this method with the following project situational deviations:
- EPA Method 320 moisture determinations were used for all calculations as they are an averaged of the entire monitoring period where psychrometric moisture determination is a single point.

EPA Method 320 defines procedures to speciate and quantify gas-phase compounds using extractive Fourier Transform Infrared Spectrometry (FTIR). A probe and sample line of inert materials draw a sample gas stream from the source and continuously deliver it to a nickel-cadmium sample cell at a constant rate. Sample interface materials and application of heat depend on the constituents of interest. Primary calibration gases are EPA Protocol 1 ethylene in nitrogen and target constituent gas calibrations occur as appropriate. Method 320 - Appendix D presents calibration trials, matrix spiking, detection limit derivations and other quality procedures. Infrared energy directed through the cell and returned to an interferometer classifies spectral separations based on the sample gas composition. Collected mid-range infrared interferograms are converted to absorbance spectra then compared to existing library reference standards to identify and quantify gas constituents. A diaphragm or rotary vane pump downstream of the cell moves the gas sample through the interface components and safely to vent. Elevated interface temperatures inhibit condensation of moisture and volatile constituents when appropriate. In some instances, elevated concentrations of water and carbon dioxide can spectrally interfere with compound(s) of interest. Water and carbon dioxide spectra are specifically or empirically developed for a sample matrix. Standardized subtraction methods are applied to sample spectra to alleviate potential spectral interferences. Sample cell pressure is monitored and maintained within ± 10 in. WC of atmospheric. The FTIR operator completes a Gas Monitoring (FTIR) Field Data Sheet as a comprehensive record of testing parameters. Details of FTIR instrumentation are shown below.

Sample Flow Rate:	3-5 LPM
Probe Material:	Stainless Steel
Transfer Lines:	Teflon™ (heated)
Sample Cells:	5.11 M
Cell Windows:	Zinc Selenide
Sample Interface Temp:	35°C
Instrument:	MKS MultiGas 2030 Gas Phase FTIR
Detector:	Mercury Cadmium Telluride (MCT)
Wave Number Range:	600-3500 cm^{-1}
Scans/Result:	16/64/128
Resolution:	0.5 cm^{-1}
Gain:	1

Pace FSD conducted this method with the following project situational deviations:
Based on project data quality objectives, EPA Method 320 was modified to exclude:

- Fractional Calibration Uncertainties (FCU) calculations
- Fractional Method Uncertainties (FMU) calculations
- Root Mean Square Deviation (RMSD) calculations
- Bias of Spiking calculations

OTM-24 defines procedures to measure airflow by quantifying a tracer gas using gas-phase extractive Fourier Transform Infrared Spectrometry (FTIR). A non-reactive tracer gas, usually sulfur hexafluoride (SF_6), is injected at a known rate well upstream of the

monitoring location to ensure the tracer is well mixed with the flue gas. A probe and sample line of inert materials draw a sample gas stream from the source and continuously deliver it to a gas-phase FTIR. The dilution ratio is determined based on the recovered tracer concentration compared to the certified cylinder value. The tracer gas flow rate is documented prior to the first test run and after the last test run using a calibrated dry-cal device. The dilution factor and the tracer gas injection flow rate are used to calculate the volumetric airflow in DSCFM.

Reference Standards. Pace implements a comprehensive program to verify and validate reference standards to further enhance and support method standards. Primary reference standards are directly comparable to a reference base. The National Institute of Standards and Technology (NIST) maintains primary reference materials or very closely traceable secondary standards. These materials are then used to certify secondary or transfer standards for use in quality management programs. Secondary reference standards are calibrated with primary standards using a high precision comparator. Materials that have a documented path to the primary standard are often referred to as traceable to NIST or NIST traceable. Where commercially and feasibly available, Pace uses primary reference standards to perform calibrations and verifications. In other cases, Pace maintains traceable secondary reference standards. Primary and secondary reference standards are used to calibrate and verify equipment and materials. Pace reference standards are calibrated by external vendors that have a formal, registered quality system. Calibrations are performed with equipment and materials that are traceable to NIST.

Quality Controls (not defined in test methods):

- Sampling/Recovery Reagents are Reagent Grade or better.
- Reference Temperature Simulator is calibrated annually.
- Reference Pressure Transducer is calibrated annually.
- Reference DryCal airflow meter is calibrated annually.
- Mercury Barometer is a primary reference standard.
- Liquid Manometers are primary reference standards.
- Angle Blocks, Gauge Blocks, and Measuring Rods are verified every five years.
- Angle Gauges are verified each day of use.
- Calipers are verified annually.
- Stainless steel reference weights are verified every five years.
- Analytical balances are calibrated annually and verified at each use.
- Field balances are calibrated annually and verified at each use.

Quality Management System. To produce data that is complete, representative, and of known precision and accuracy, Pace Analytical Field Services Division has designed and implemented a rigorous and innovative quality management system. The system was initially based on the USEPA Quality Assurance Handbook for Air Pollution Measurement Systems and continually developed as procedural complexities and standards progressed. The Field Services Division Quality Management System (Pace

FSD QMS) is now accredited by the American Association of Laboratory Accreditation (A2LA) to comply with three national accreditation standards:

- ASTM D7036 - Standard Practice for Competence of Air Emission Testing Bodies (AETB).
- ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
- The NELAC Institute - General Requirements for Field Sampling and Measurement Organizations (FSMO)

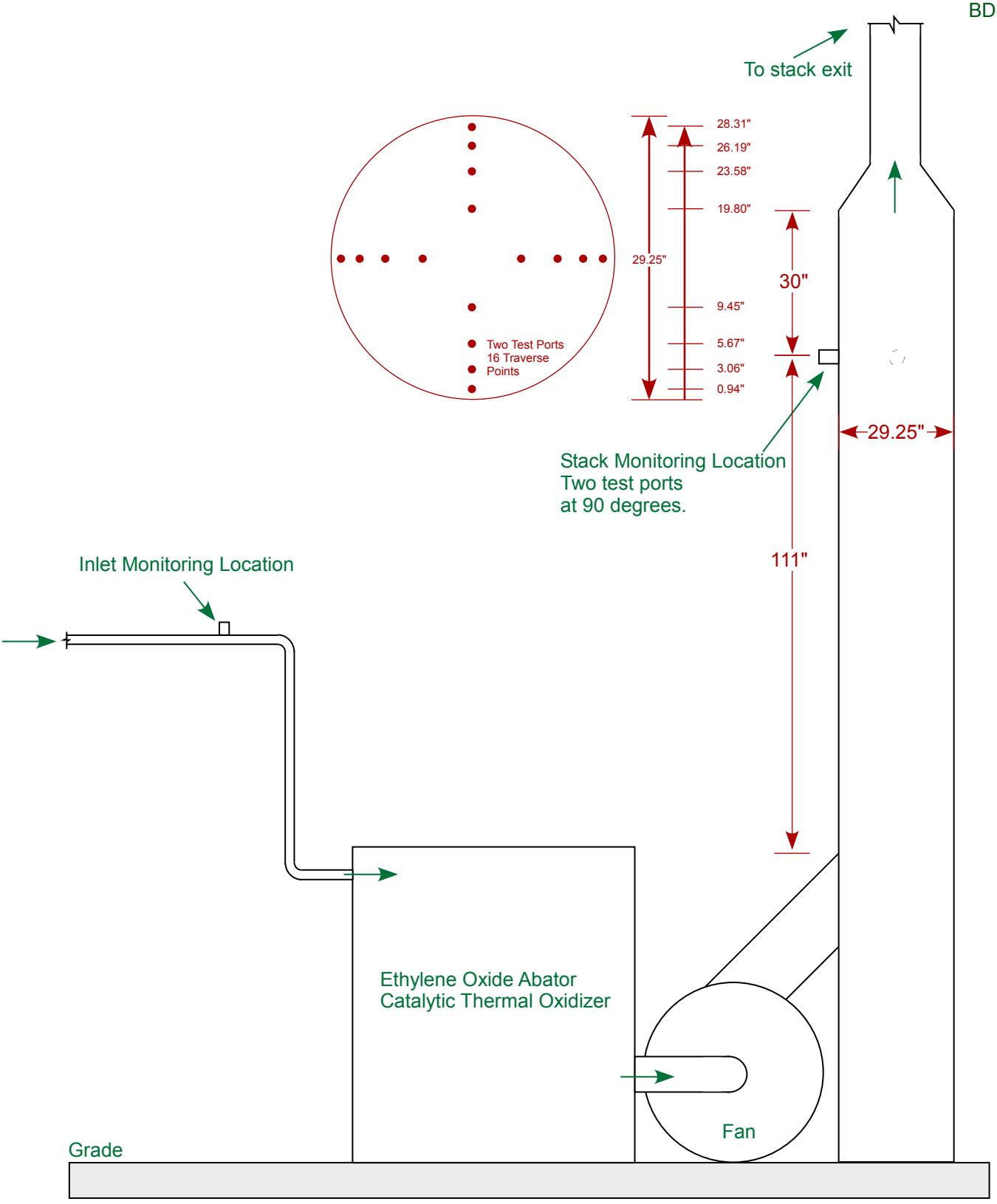
The Pace FSD QMS includes:

- Quality Programs
  - Ethics policy and training.
  - Corrective Action and Preventative Action (CAPA).
  - Continuous Process Improvement.
  - Documented Demonstrations of Capability.
  - Internal and third party proficiency testing.
  - Qualified Individual program (QI)
  - Internal and external audits.
  - Annual management reviews.
- Documentation and Traceability
  - High quality traceable standards and reagents.
  - Reagent tracking and management system.
  - Use of matrix spikes, duplicate analysis, internal standards, and blanks.
  - Validated workbooks for data collection and results reporting.
  - Electronic quality, training, and safety documents available in-field.
  - Sample security and preservation procedures.
  - Chain of custody maintained from sample collection through laboratory analysis.
- Equipment Calibration
  - Full time staff dedicated to equipment maintenance and calibration.

All equipment and instruments are calibrated by trained personnel on a frequency that meets or exceeds method requirements.

Pace Analytical
Field Services Division

Figure 1
3M Health Care
Brookings, SD
Ethylene Oxide Abator Catalytic Thermal Oxidizer
BDE \ 06/19



Report Signatures

Field Testing and Reporting Performed by: Pace Analytical Services, LLC
Field Services Division
1700 Elm Street, Suite 200
Minneapolis, MN 55414

Field Testing Affirmation

All field testing was performed in accordance with stated test methods subject to modifications and deviations listed herein. Raw field data presented in this report accurately reflects results and information as recorded at the time of tests or otherwise noted.

Report Affirmation

To the best of my knowledge, this report accurately represents the compiled field and laboratory information with no material omissions, alterations or misrepresentations.

Date 6/5/19

Brett D. Erickson, QSTI
Project Manager

Responsible Charge Affirmation

I have reviewed the information herein and it is approved for distribution.

Date 6/5/19

Donald B. Stock, QEP, QSTI
General Manager, Field Services Division

Appendix A

Field Data Sheets and Documentation

EPA Method 1 Field Data Sheets

EPA Method 1 Field Data Sheet
Test Site and Traverse Point Selection

Pace Analytical® Field Services Division

Project 3M Brookings
Test Location Ethylene Oxide Abator- Outlet/Inlet
Date 4/23/19 Test/Run 1/1
Tech(s) [illegible]

☒ New Sketch Created With Dimensions
☐ File Drawing Verified and Attached
☒ Cyclonic Flow Measured (See M-2 Sheet)

A= 30"
B= 111"
Flow Disturbance

Disturbance Type

Before (B)		After (A)
☐	Elbow	☐
☒	Conjunction	☐
☐	Fan (cent)	☐
☐	Axial Fan	☐
☐	Transition	☒
☐	Damper	☐
☐	Exit	☐
☐	Other _____	☐

☒ Round
D= 29.25"
29.25" =W
6.25" port

☐ Rectangular
W= _____ Ports This Side
=D

Duct Orientation
☒ Vertical
☐ Horizontal
☐ Diagonal

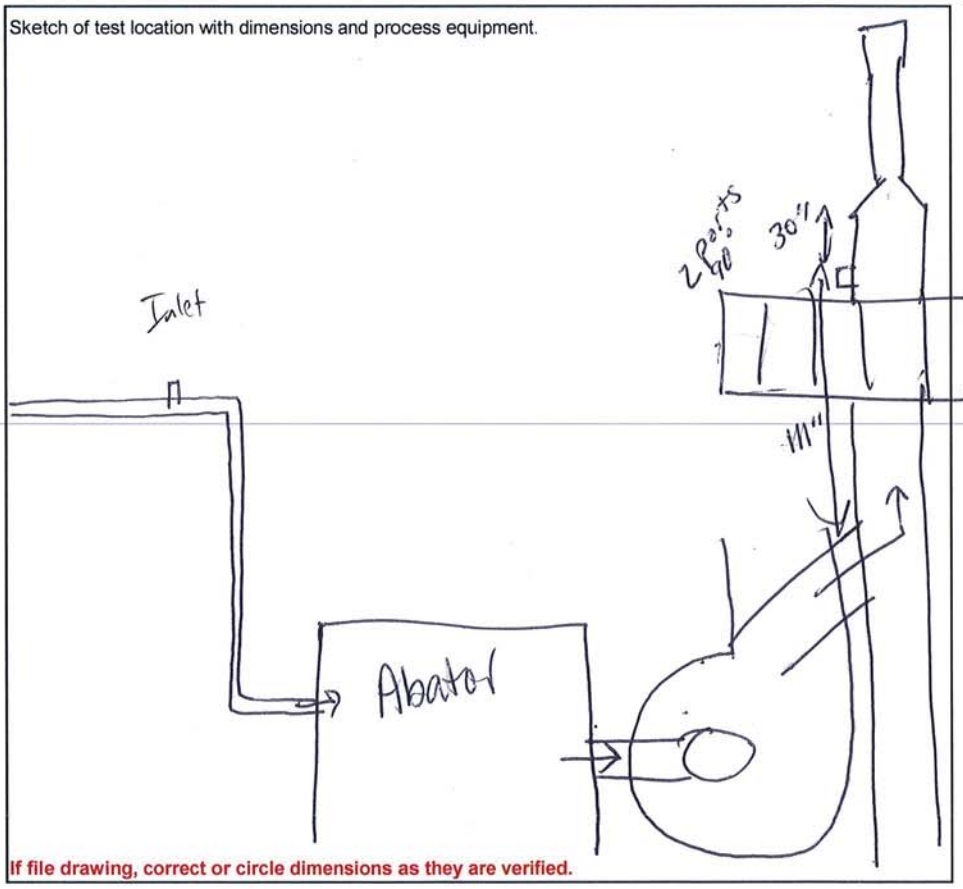
2 No. of Traverses

A= 1.0 Diameters to downstream
B= 3.8 Diameters to upstream
T_R= 24 Min. Traverse Points (iso)
T_A= 16 Traverse Points Used

Traverse Points (from wall)

Wall	Port
0.94	7.19
3.06	9.31
5.67	11.92
9.45	15.70
19.80	26.05
23.58	29.83
26.19	32.44
28.31	34.56

Sketch of test location with dimensions and process equipment.



If file drawing, correct or circle dimensions as they are verified.

EPA Method 2 Field Data Sheets

Pace Analytical® Field Services Division

EPA Method 2 Field Data Sheet

Volumetric Airflow Determinations

Project: 3M Brookings
Test Location: Ethylene Oxide Abator Stack
Date: 4/23/19 Test/Run: 1/1-3
Duct Dimensions: 29.25 x 29.25 Inches
Port Length: 6.25 Inches
Pitot Leak Check - Pos: ✓ Neg: ✓

Manometer Type and ID: DM-30, AM-3
Barometer Type and ID: DB-59
Thermocouple Sensor ID: TC-31
Pitot Tube No.: 3-15 Cp: 0.84
Technicians: BDE/DJL

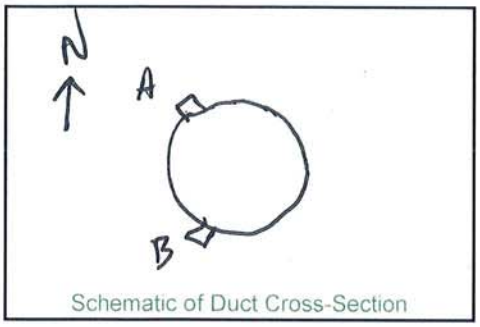
Anemometer ft/min

Traverse Point IDs			Cyclonic	Velocity Head - Inches H_2O				Stack Temperature °F			
Point No.	Inches From Wall	Inches From Port	Flow °Yaw	Run 1 ΔP	Run 2 ΔP	Run 3 ΔP	Run 4 ΔP	Run 1 °F	Run 2 °F	Run 3 °F	Run 4 °F
A-1	0.94	7.19	0	0.000	0.000	0.002		0	0	0	
2	3.06	9.31	0	0.000	0.000	0.000		0	0	0	
3	5.67	11.92	0	0.000	0.001	0.001		0	60	50	
4	9.45	15.70	0	0.000	0.001	0.000		40	0	40	
5	19.80	26.05	0	0.000	0.001	0.001		40	0	0	
6	23.58	29.83	0	0.000	0.001	0.001		40	50	30	
7	26.19	32.44	0	0.000	0.001	0.002		40	50	30	
8	28.31	34.56	0	0.000	0.000	0.000		0	0	0	
B-1	same	same	0	0.000	0.000	0.000		0	0	0	
2			0	0.000	0.000	0.000		0	0	40	
3			0	0.000	0.001	0.002		40	0	40	
4			0	0.000	0.000	0.001		40	40	0	
5			0	0.000	0.002	0.000		40	50	40	
6			0	0.000	0.000	0.000		40	30	40	
7			0	0.000	0.001	0.000		0	30	0	
8			0	~~0.000~~	0.000	0.000		0	0	0	
				0.002				(Avg: 20)	Avg (19.375)	Avg (19.375)	

BDE 4/23/19

RDE 4/23/19

RDE 4/23/19



Schematic of Duct Cross-Section

	Run 1	Run 2	Run 3	Run 4	
Bar. Pressure	28.401	28.401	28.401		"Hg
Static Pressure	-0.044	-0.045	-0.063		"H_2O
Dry Bulb Temp.	~~205~~ 214	201	216		°F
Wet Bulb Temp.	93.5	94.4	100.3		°F
Moisture Content	1.1	1.6	2.4		%v/v
320 P Oxygen	20.9	20.9	20.9		%v/v
Time of Meas.	1000	1200	1430		(24 Hour)

RDE 4/23/19

Gas Monitoring (FTIR) Field Data Sheets

Gas Monitoring (FTIR) Field Data Sheet

Pace Analytical Field Services Division

EPA Methods 318, 320 & 321

Page 1 of 1

Project: 3M Brookings
Test Location: Ethylene Oxide Abitor Inlet
Test Date: 4/23/19 Test No. 1
Data Directory: MKS2_23Apr19
Leak Check: Initial ✓ Final ✓ Pass ☑
Response Time to Sample: 0:20 min:sec
Barometer ID: 59 P_b: 28.401 in. Hg / 0.9493 PSI / Atm

Operators: BOE/DJL
FTIR ID: MKS2 Computer ID: MKS2
IR Optical Pathlength: 5.11 meters
Quality Level: ☐ Screening ☐ Quantitative ☒ Compliance ☐ Validation
Response Time to Span: 0:40 min
Cell Heat Controller ID: 10, 11

Gas Std

Calibration Gas Std.	Ethylene
Concentration, PPMv	19.8ppmv
Cylinder Identification	EB00 79337
Expiration Date	12/18/23

Spiking Gas Std.	See Stack
Concentration, PPMv	BOE
Cylinder Identification	4/23/19
Expiration Date	

Sample Scan Documentation

File Name	Time (24hr)	Sample Scan Location and Description	Temp °C	Flow LPM	Cell Pres.	No. of Scans
1-8	652	- leak check	37	0	0.64	64
9-17	700	+ Leak check Valve Bumped slightly open - use 13-	37	0	1.22	64
18-22	734	- leak check	37	0	0.72	64
23-27	741	+ Leak check	37	0	1.20	64
28-33	753	Nitrogen	37	3	0.986	64/128
34-42	806	19.8 ppm Ethylene	37	3	0.985	16
43-73	811	100 ppm Ethylene Oxide	37	3	0.983	16
74-184	832	Diluted Inlet Gas w/ SF6 Tracer (cc 99697-1000ppmv - 5/11/21)	37	3	0.980	128/16
		Turned Dilution off @ 1046				
		End Run @ 1102				
185-	1100	Nitrogen	37	3	0.981	128
186-192	1113	19.8ppm Ethylene	37	3	0.981	16
193-	1118	Diluted Inlet Gas	37	3	0.981	128
252-256	1327	Nitrogen	37	3	0.968	128
257-262	1331	19.8ppmEthylene	37	3	0.968	16
263-318	1335	Diluted Inlet Gas	37	3	0.967	128
319-	1551	Nitrogen	37	3	0.981	16/128
334	1559	19.8ppm Ethylene	37	3	0.991	16
339-	1602	4.95ppm SF6 - St 11887 - exp: 5/11/21	37	3	0.991	16
349-354	1608	- leak check	37	0	0.596	16
365-380	1615	+ leak check	37	0	1.15	16

Comments:

BOE 4/23/19

Gas Monitoring (FTIR) Field Data Sheet

EPA Methods 318, 320 & 321

Page 1 of 2

Project: 3M Brookings
Test Location: Ethylene Oxide Abator Stack
Test Date: 4/23/19 Test No. 1
Data Directory: MKS3_23Apr19
Leak Check: Initial ✓ Final ✓ Pass ☑
Response Time to Sample: 0:20 min:sec
Barometer ID 59 P_b: 28.401 in. Hg / 0.9493 PSI / Atm

Operators: BOE / DJL
FTIR ID: MKS3 Computer ID: MKS3
IR Optical Pathlength: 5.11 meters
Quality Level: ☐ Screening ☐ Quantitative ☒ Compliance ☐ Validation
Response Time to Span: 0:40 min
Cell Heat Controller ID: 12, 13

Gas Std

Calibration Gas Std.	Ethylene
Concentration, PPMv	19.8
Cylinder Identification	EB0079337
Expiration Date	12/18/23

Spiking Gas Std.	Ethylene Oxide
Concentration, PPMv	100
Cylinder Identification	EB0105491
Expiration Date	1/16/20

Sample Scan Documentation

File Name	Time (24hr)	Sample Scan Location and Description	Temp °C	Flow LPM	Cell Pres.	No. of Scans
1-4	648	- leak check	35	0	0.226	64
5-8	659	+ leak check	35	0	1.21	64
9-28	714	Nitrogen	35	3	0.936	64/128
29-40	807	19.8 ppm Ethylene	35	3	0.937	16
41-48	811	100 ppm Ethylene Oxide	35	3	0.936	16
50-118		Stack Gas Start Run @ 858	35	3	0.935	128
—	—	End Run @ 1102				
119-	1112	Nitrogen	36	3	0.932	128
120-125	1114	19.8ppm Ethylene	36	3	0.932	16
126-181	1118	Stack Gas Start Batch 2 @ 1130	36	3	0.931	128
—	—	End Batch 2 @ 1322				
185-189	1328	Nitrogen	36	3	0.927	128
190-195	1332	19.8ppm Ethylene	36	3	0.927	16
196-251	1336	Stack Gas Start Batch 3 @ 1348	36	3	0.927	128
—	—	End @ 1533				
252-280	1540	Pre Spiked Stack Gas	36	3	0.914	16
—	—	3.60 3.30 (Pre)				
—	—	3.63 3.33 (Post)				
281-294	1552	Nitrogen	36	3	0.913	128/16
295-299	1600	19.8ppm Ethylene	36	3	0.913	16

Comments: SF_6 Tracer - 1000ppm - CC99697 - Exp. 5/11/21

Gas Monitoring (FTIR) Field Data Sheet

Pace Analytical Field Services Division

EPA Methods 318, 320 & 321

#REF! Page 2 of 2

Project 3M Brootings
Test Location Ethylene Oxide Abator Stack
Test Date 4/23/19 Test No. 1

Operators BDE
Data Directory MKS 3 - 23Apr19

Sample Scan Documentation

File Name	Time (24hr)	Sample Scan Location and Description	Temp °C	Flow LPM	Cell Pres.	No. of Scans
300-305	1602	4.95ppm SF_6 - SA11887 - exp: 5/11/21	37	3	0.913	16
306-325	1607	- leak check	37	0	0.543	16
326-316	1616	+ leak check	37	0	1.19	16

BDE 4/23/19

Comments:

Tracer Gas Field Data Log Sheet

Pace Analytical® Field Services Division

Tracer Gas Field Data Log Sheet

Page 1 of 1

Client Name 3M Brookings	Pace Project # 19-01569
Project Location Abater Vent (lab)	Client Project #
On-Site Contact 4/23/19 ~~Abater vent~~	Sample Date 4/23/19
Auditor(s)	Technician(s) DJL

Pre-run tracer flow: 318 ml/min DC-10

Post run tracer flow 318 $\frac{ml}{min}$ DC-10

6/2/19

Attach additional notes if necessary.

Lead Technician Signature: Daniel Lyons Date: 6/2/19

Appendix B

Quantitation and Laboratory Reports

FTIR Monitoring Log

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000001.LAB	4/23/2019 6:52	224	0	0	1.07	37.0	0.641
MKS2__000002.LAB	4/23/2019 6:53	225	0	0	1.08	37.0	0.637
MKS2__000003.LAB	4/23/2019 6:54	226	0	0	1.08	37.1	0.636
MKS2__000004.LAB	4/23/2019 6:55	226	0	0	1.09	37.1	0.635
MKS2__000005.LAB	4/23/2019 6:56	227	0	0	1.09	37.2	0.634
MKS2__000006.LAB	4/23/2019 6:57	227	0	0	1.09	37.1	0.634
MKS2__000007.LAB	4/23/2019 6:58	226	0	0	1.09	37.1	0.634
MKS2__000008.LAB	4/23/2019 6:59	226	0	0	1.09	37.1	0.635
MKS2__000009.LAB	4/23/2019 7:02	118	0	0	0.913	37.2	1.22
MKS2__000010.LAB	4/23/2019 7:03	121	0	0	0.904	37.2	1.19
MKS2__000011.LAB	4/23/2019 7:04	124	0	0	0.894	37.2	1.17
MKS2__000012.LAB	4/23/2019 7:05	127	0	0	0.888	37.2	1.15
MKS2__000013.LAB	4/23/2019 7:15	114	0	0	0.811	37.1	1.30
MKS2__000014.LAB	4/23/2019 7:16	116	0	0	0.807	37.1	1.27
MKS2__000015.LAB	4/23/2019 7:17	122	0	0	0.807	37.0	1.20
MKS2__000016.LAB	4/23/2019 7:19	130	0	0	0.817	37.1	1.12
MKS2__000017.LAB	4/23/2019 7:20	138	0	0	0.828	37.1	1.06
MKS2__000018.LAB	4/23/2019 7:34	202	0	0	0.923	36.8	0.722
MKS2__000019.LAB	4/23/2019 7:35	197	0	0	0.895	36.9	0.735
MKS2__000020.LAB	4/23/2019 7:36	195	0	0	0.870	36.9	0.745
MKS2__000021.LAB	4/23/2019 7:37	192	0	0	0.846	36.8	0.755
MKS2__000022.LAB	4/23/2019 7:38	188	0	0	0.825	36.9	0.763
MKS2__000023.LAB	4/23/2019 7:41	117	0	0	0.747	36.8	1.20
MKS2__000024.LAB	4/23/2019 7:42	119	0	0	0.743	36.9	1.18
MKS2__000025.LAB	4/23/2019 7:43	122	0	0	0.741	36.9	1.16
MKS2__000026.LAB	4/23/2019 7:44	123	0	0	0.740	36.8	1.14
MKS2__000027.LAB	4/23/2019 7:45	125	0	0	0.741	36.8	1.13
MKS2__000028BKG.LAB	4/23/2019 7:55	0	0	0	0	36.9	0.986
MKS2__000029.LAB	4/23/2019 7:56	0	0	0	0	36.9	0.986
MKS2__000030BKG.LAB	4/23/2019 7:59	0	0	0	0	36.9	0.986

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000031BKG.LAB	4/23/2019 8:01	0	0	0	0	37.0	0.986
MKS2__000032.LAB	4/23/2019 8:02	0	0	0	0	36.9	0.985
MKS2__000033BKG.LAB	4/23/2019 8:04	0	0	0	0	36.9	0.985
MKS2__000034.LAB	4/23/2019 8:07	0	0	19.8	0	36.9	0.985
MKS2__000035.LAB	4/23/2019 8:07	0	0	19.9	0	36.9	0.985
MKS2__000036.LAB	4/23/2019 8:08	0	0	19.9	0	36.9	0.984
MKS2__000037.LAB	4/23/2019 8:08	0	0	19.8	0	36.9	0.984
MKS2__000038.LAB	4/23/2019 8:09	0	0	19.9	0	36.9	0.984
MKS2__000039.LAB	4/23/2019 8:09	0	0	19.9	0	36.9	0.984
MKS2__000040.LAB	4/23/2019 8:10	0	0	19.9	0	36.9	0.984
MKS2__000041.LAB	4/23/2019 8:10	0	0	19.8	0	36.9	0.984
MKS2__000042.LAB	4/23/2019 8:10	0	0	19.9	0	36.9	0.984
MKS2__000043.LAB	4/23/2019 8:12	1.31	0	0	0	36.9	0.983
MKS2__000044.LAB	4/23/2019 8:12	9.81	0	0	0	36.9	0.983
MKS2__000045.LAB	4/23/2019 8:12	26.6	0	0	0	36.9	0.975
MKS2__000046.LAB	4/23/2019 8:13	35.4	0.0572	0	0	36.8	0.974
MKS2__000047.LAB	4/23/2019 8:13	41.3	0.0602	0	0	36.8	0.974
MKS2__000048.LAB	4/23/2019 8:13	46.0	0.0646	0	0	36.9	0.973
MKS2__000049.LAB	4/23/2019 8:13	50.5	0.0629	0	0	36.9	0.974
MKS2__000050.LAB	4/23/2019 8:14	55.6	0.0600	0	0	36.8	0.973
MKS2__000051.LAB	4/23/2019 8:14	59.2	0.0575	0	0	36.9	0.974
MKS2__000052.LAB	4/23/2019 8:14	62.5	0.0584	0	0	36.9	0.973
MKS2__000053.LAB	4/23/2019 8:14	68.2	0.0386	0	0	36.9	0.974
MKS2__000054.LAB	4/23/2019 8:15	83.9	0	0	0	36.8	0.973
MKS2__000055.LAB	4/23/2019 8:15	87.3	0	0	0	36.8	0.974
MKS2__000056.LAB	4/23/2019 8:15	88.2	0	0	0	36.8	0.973
MKS2__000057.LAB	4/23/2019 8:16	87.5	0	0	0	36.9	0.974
MKS2__000058.LAB	4/23/2019 8:16	91.2	0	0	0	36.9	0.973
MKS2__000059.LAB	4/23/2019 8:16	92.6	0	0	0	36.8	0.973
MKS2__000060.LAB	4/23/2019 8:16	92.9	0	0	0	36.8	0.973

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000061.LAB	4/23/2019 8:17	92.9	0	0	0	36.9	0.973
MKS2__000062.LAB	4/23/2019 8:17	94.6	0	0	0	36.9	0.974
MKS2__000063.LAB	4/23/2019 8:17	95.1	0	0	0	36.8	0.974
MKS2__000064.LAB	4/23/2019 8:17	94.8	0	0	0	36.9	0.974
MKS2__000065.LAB	4/23/2019 8:18	96.3	0	0	0	36.9	0.974
MKS2__000066.LAB	4/23/2019 8:18	98.0	0	0	0	36.8	0.974
MKS2__000067.LAB	4/23/2019 8:18	98.4	0	0	0	36.8	0.974
MKS2__000068.LAB	4/23/2019 8:18	98.1	0	0	0	36.8	0.974
MKS2__000069.LAB	4/23/2019 8:19	97.7	0	0	0	36.8	0.974
MKS2__000070.LAB	4/23/2019 8:19	98.9	0	0	0	36.9	0.974
MKS2__000071.LAB	4/23/2019 8:19	98.2	0	0	0	36.8	0.974
MKS2__000072.LAB	4/23/2019 8:20	99.9	0	0	0	36.9	0.974
MKS2__000073.LAB	4/23/2019 8:20	100	0	0	0	36.9	0.974
MKS2__000074.LAB	4/23/2019 8:35	0	0.226	8.89	0.117	36.9	0.980
MKS2__000075.LAB	4/23/2019 8:37	0	0.225	8.97	0.116	36.8	0.980
MKS2__000076.LAB	4/23/2019 8:37	0.963	0.228	8.83	0.117	36.9	0.980
MKS2__000077.LAB	4/23/2019 8:37	0	0.224	8.95	0.116	36.8	0.982
MKS2__000078.LAB	4/23/2019 8:38	1.10	0.149	12.5	0.115	36.9	0.984
MKS2__000079.LAB	4/23/2019 8:38	1.49	0.0543	16.9	0.0922	36.8	0.985
MKS2__000080.LAB	4/23/2019 8:38	2.45	0	18.9	0.0701	36.9	0.985
MKS2__000081.LAB	4/23/2019 8:38	1.48	0.0267	18.2	0	36.9	0.984
MKS2__000082.LAB	4/23/2019 8:39	0	0.0676	16.3	0	36.8	0.985
MKS2__000083.LAB	4/23/2019 8:39	0	0.0643	16.4	0	36.8	0.985
MKS2__000084.LAB	4/23/2019 8:39	0	0.0664	16.4	0	36.8	0.985
MKS2__000085.LAB	4/23/2019 8:39	0	0.0807	15.7	0	36.8	0.984
MKS2__000086.LAB	4/23/2019 8:40	0.951	0.112	14.2	0	36.8	0.984
MKS2__000087.LAB	4/23/2019 8:40	1.44	0.118	13.9	0	36.9	0.984
MKS2__000088.LAB	4/23/2019 8:40	2.94	0.118	14.0	0	36.8	0.984
MKS2__000089.LAB	4/23/2019 8:40	1.86	0.118	14.0	0	36.9	0.984
MKS2__000090.LAB	4/23/2019 8:41	1.34	0.118	14.0	0	36.9	0.984

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000091.LAB	4/23/2019 8:41	1.38	0.114	14.2	0	36.8	0.985
MKS2__000092.LAB	4/23/2019 8:41	2.28	0.0542	16.9	0	36.9	0.985
MKS2__000093.LAB	4/23/2019 8:41	0	0.0438	17.4	0	36.9	0.985
MKS2__000094.LAB	4/23/2019 8:42	1.53	0.0408	17.6	0	36.9	0.985
MKS2__000095.LAB	4/23/2019 8:42	1.04	0.0387	17.7	0	36.9	0.985
MKS2__000096.LAB	4/23/2019 8:42	0	0.0379	17.7	0	36.8	0.985
MKS2__000097.LAB	4/23/2019 8:42	0	0.0431	17.6	0	36.8	0.985
MKS2__000098.LAB	4/23/2019 8:43	0	0.0413	17.6	0	36.8	0.985
MKS2__000099.LAB	4/23/2019 8:43	1.30	0.0429	17.5	0	36.9	0.985
MKS2__000100.LAB	4/23/2019 8:43	0	0.0443	17.4	0	36.9	0.985
MKS2__000101.LAB	4/23/2019 8:44	0	0.0434	17.4	0	36.9	0.985
MKS2__000102.LAB	4/23/2019 8:44	1.61	0.0451	17.4	0	36.8	0.985
MKS2__000103.LAB	4/23/2019 8:44	0	0.0417	17.5	0	36.9	0.986
MKS2__000104.LAB	4/23/2019 8:44	0.786	0.0399	17.6	0	36.8	0.985
MKS2__000105.LAB	4/23/2019 8:45	0	0.0426	17.5	0	36.9	0.985
MKS2__000106.LAB	4/23/2019 8:45	1.10	0.0433	17.5	0	36.9	0.986
MKS2__000107.LAB	4/23/2019 8:45	0	0.0437	17.6	0	36.9	0.986
MKS2__000108.LAB	4/23/2019 8:45	0	0.0397	17.7	0	36.8	0.985
MKS2__000109.LAB	4/23/2019 8:46	0	0.0457	17.4	0	36.9	0.985
MKS2__000110.LAB	4/23/2019 8:46	0	0.130	13.3	0	36.9	0.985
MKS2__000111.LAB	4/23/2019 8:46	0	0.0755	15.8	0	36.9	0.985
MKS2__000112.LAB	4/23/2019 8:46	0	0.0467	17.3	0	36.9	0.985
MKS2__000113.LAB	4/23/2019 8:47	0	0.0430	17.5	0	36.9	0.985
MKS2__000114.LAB	4/23/2019 8:47	0	0.0431	17.5	0	36.9	0.985
MKS2__000115.LAB	4/23/2019 8:47	0	0.0510	17.1	0	36.9	0.984
MKS2__000116.LAB	4/23/2019 8:47	0	0.0985	14.9	0	36.8	0.984
MKS2__000117.LAB	4/23/2019 8:48	0	0.101	14.7	0	36.8	0.985
MKS2__000118.LAB	4/23/2019 8:48	0	0.0991	14.9	0	36.8	0.984
MKS2__000119.LAB	4/23/2019 8:48	0	0.0988	14.9	0	36.9	0.984
MKS2__000120.LAB	4/23/2019 8:48	0	0.0971	14.9	0	36.9	0.984

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000121.LAB	4/23/2019 8:49	0	0.0983	14.9	0	36.8	0.984
MKS2__000122.LAB	4/23/2019 8:51	0	0.0929	15.2	0	36.8	0.983
MKS2__000123.LAB	4/23/2019 8:53	0	0.0891	15.4	0	36.8	0.982
MKS2__000124.LAB	4/23/2019 8:56	0	0.0807	15.7	0	36.8	0.982
MKS2__000125.LAB	4/23/2019 8:58	0	0.0764	16.0	0	36.8	0.982
MKS2__000126.LAB	4/23/2019 9:00	2.67	0.0664	16.2	0	36.8	0.983
MKS2__000127.LAB	4/23/2019 9:02	11.3	0.0638	16.1	0	36.8	0.984
MKS2__000128.LAB	4/23/2019 9:04	0	0.0664	16.0	0	36.8	0.984
MKS2__000129.LAB	4/23/2019 9:06	2.30	0.0509	16.8	0	36.8	0.984
MKS2__000130.LAB	4/23/2019 9:08	31.7	0.0525	16.7	0	36.8	0.984
MKS2__000131.LAB	4/23/2019 9:10	15.9	0.0536	16.7	0	36.8	0.984
MKS2__000132.LAB	4/23/2019 9:12	7.44	0.0576	16.5	0	36.8	0.984
MKS2__000133.LAB	4/23/2019 9:14	3.85	0.0522	16.8	0	36.8	0.984
MKS2__000134.LAB	4/23/2019 9:16	1.84	0.0384	17.5	0	36.8	0.984
MKS2__000135.LAB	4/23/2019 9:19	6.38	0.0969	14.8	0	36.8	0.984
MKS2__000136.LAB	4/23/2019 9:21	4.94	0.0949	15.0	0	36.8	0.984
MKS2__000137.LAB	4/23/2019 9:23	2.41	0.0854	15.3	0	36.8	0.984
MKS2__000138.LAB	4/23/2019 9:25	5.11	0.0778	15.8	0	36.8	0.984
MKS2__000139.LAB	4/23/2019 9:27	4.32	0.161	11.9	0.0713	36.8	0.985
MKS2__000140.LAB	4/23/2019 9:29	6,369	0	12.2	0	36.8	0.987
MKS2__000141.LAB	4/23/2019 9:31	11,976	0	13.9	0.0694	36.7	0.987
MKS2__000142.LAB	4/23/2019 9:33	2,721	0.0648	14.9	0	36.8	0.987
MKS2__000143.LAB	4/23/2019 9:35	1,308	0.0766	15.3	0	36.8	0.987
MKS2__000144.LAB	4/23/2019 9:38	1,071	0.0771	15.5	0	36.8	0.986
MKS2__000145.LAB	4/23/2019 9:40	577	0.0770	15.7	0	36.8	0.986
MKS2__000146.LAB	4/23/2019 9:42	830	0.0691	15.8	0	36.8	0.987
MKS2__000147.LAB	4/23/2019 9:44	693	0.0648	16.0	0	36.8	0.987
MKS2__000148.LAB	4/23/2019 9:46	341	0.0622	16.2	0	36.8	0.987
MKS2__000149.LAB	4/23/2019 9:48	534	0.0578	16.4	0	36.8	0.987
MKS2__000150.LAB	4/23/2019 9:50	362	0.0554	16.5	0	36.8	0.987

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000151.LAB	4/23/2019 9:52	200	0.0530	16.5	0	36.8	0.987
MKS2__000152.LAB	4/23/2019 9:54	110	0.0523	16.6	0	36.8	0.987
MKS2__000153.LAB	4/23/2019 9:56	88.6	0.0807	15.2	0	36.8	0.986
MKS2__000154.LAB	4/23/2019 9:58	52.6	0.0851	15.1	0	36.8	0.986
MKS2__000155.LAB	4/23/2019 10:01	28.9	0.0800	15.4	0	36.8	0.986
MKS2__000156.LAB	4/23/2019 10:03	19.5	0.0760	15.4	0	36.8	0.986
MKS2__000157.LAB	4/23/2019 10:05	12.4	0.0760	15.5	0	36.8	0.985
MKS2__000158.LAB	4/23/2019 10:07	6.71	0.0702	15.7	0	36.7	0.985
MKS2__000159.LAB	4/23/2019 10:09	3.19	0.0694	15.8	0	36.7	0.985
MKS2__000160.LAB	4/23/2019 10:11	1.15	0.0693	15.9	0	36.7	0.984
MKS2__000161.LAB	4/23/2019 10:13	0	0.0687	15.9	0	36.7	0.984
MKS2__000162.LAB	4/23/2019 10:15	0	0.0683	16.0	0	36.7	0.983
MKS2__000163.LAB	4/23/2019 10:17	0	0.0665	16.1	0	36.7	0.983
MKS2__000164.LAB	4/23/2019 10:19	0	0.0644	16.1	0	36.7	0.983
MKS2__000165.LAB	4/23/2019 10:22	17.3	0.0631	16.1	0	36.7	0.983
MKS2__000166.LAB	4/23/2019 10:24	0	0.0616	16.2	0	36.6	0.983
MKS2__000167.LAB	4/23/2019 10:26	0	0.0603	16.4	0	36.6	0.982
MKS2__000168.LAB	4/23/2019 10:28	0	0.0604	16.4	0	36.6	0.982
MKS2__000169.LAB	4/23/2019 10:30	0	0.0931	14.8	0	36.6	0.982
MKS2__000170.LAB	4/23/2019 10:32	0	0.113	13.7	0	36.6	0.982
MKS2__000171.LAB	4/23/2019 10:34	0	0.107	13.8	0	36.6	0.983
MKS2__000172.LAB	4/23/2019 10:36	0	0.105	13.9	0	36.6	0.984
MKS2__000173.LAB	4/23/2019 10:38	0	0.100	14.1	0	36.6	0.985
MKS2__000174.LAB	4/23/2019 10:40	0	0.100	14.2	0	36.6	0.985
MKS2__000175.LAB	4/23/2019 10:42	0	0.100	14.3	0	36.6	0.985
MKS2__000176.LAB	4/23/2019 10:45	0	0.100	14.3	0	36.6	0.985
MKS2__000177.LAB	4/23/2019 10:47	0	0.122	13.2	0	36.6	0.984
MKS2__000178.LAB	4/23/2019 10:49	0	0.373	0	0.193	36.6	0.983
MKS2__000179.LAB	4/23/2019 10:51	0	0.372	0	0.230	36.6	0.983
MKS2__000180.LAB	4/23/2019 10:53	0	0.371	0	0.231	36.6	0.982

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000181.LAB	4/23/2019 10:55	0	0.374	0	0.229	36.6	0.981
MKS2__000182.LAB	4/23/2019 10:57	0	0.376	0	0.231	36.6	0.981
MKS2__000183.LAB	4/23/2019 10:59	0	0.375	0	0.235	36.6	0.980
MKS2__000184.LAB	4/23/2019 11:01	0	0.376	0	0.239	36.6	0.980
MKS2__000185BKG.LAB	4/23/2019 11:12	0	0	0	0	36.6	0.981
MKS2__000186.LAB	4/23/2019 11:14	0	0	19.8	0	36.6	0.981
MKS2__000187.LAB	4/23/2019 11:14	1.14	0	19.9	0	36.6	0.981
MKS2__000188.LAB	4/23/2019 11:14	1.52	0	19.8	0	36.6	0.981
MKS2__000189.LAB	4/23/2019 11:15	1.99	0	19.9	0	36.6	0.981
MKS2__000190.LAB	4/23/2019 11:15	1.75	0	19.8	0	36.6	0.981
MKS2__000191.LAB	4/23/2019 11:15	0	0	20.0	0	36.6	0.981
MKS2__000192.LAB	4/23/2019 11:15	0	0	19.9	0	36.6	0.981
MKS2__000193.LAB	4/23/2019 11:20	2.16	0.0978	15.0	0	36.7	0.981
MKS2__000194.LAB	4/23/2019 11:22	1.58	0.0907	15.1	0	36.6	0.981
MKS2__000195.LAB	4/23/2019 11:25	1.65	0.0777	15.4	0	36.6	0.982
MKS2__000196.LAB	4/23/2019 11:27	1.31	0.0724	15.7	0	36.6	0.982
MKS2__000197.LAB	4/23/2019 11:29	0	0.0694	15.9	0	36.6	0.981
MKS2__000198.LAB	4/23/2019 11:31	2.26	0.134	12.6	0.0667	36.6	0.980
MKS2__000199.LAB	4/23/2019 11:33	2.33	0.128	13.0	0.0667	36.6	0.980
MKS2__000200.LAB	4/23/2019 11:35	2.11	0.124	13.4	0.0610	36.5	0.980
MKS2__000201.LAB	4/23/2019 11:37	2.13	0.130	13.6	0	36.6	0.979
MKS2__000202.LAB	4/23/2019 11:39	2.31	0.121	13.7	0	36.5	0.979
MKS2__000203.LAB	4/23/2019 11:41	2.13	0.124	13.5	0.0776	36.5	0.978
MKS2__000204.LAB	4/23/2019 11:43	2.55	0.145	12.9	0.0696	36.5	0.977
MKS2__000205.LAB	4/23/2019 11:45	1.99	0.142	13.1	0.0647	36.5	0.977
MKS2__000206.LAB	4/23/2019 11:48	9,246	0	13.1	0	36.5	0.977
MKS2__000207.LAB	4/23/2019 11:50	13,642	0.0510	12.5	0.0770	36.5	0.977
MKS2__000208.LAB	4/23/2019 11:52	3,835	0.0976	12.6	0.0810	36.5	0.976
MKS2__000209.LAB	4/23/2019 11:54	1,971	0.128	12.8	0.0884	36.5	0.976
MKS2__000210.LAB	4/23/2019 11:56	1,205	0.136	12.9	0.0859	36.5	0.976

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000211.LAB	4/23/2019 11:58	918	0.135	13.0	0.0804	36.5	0.976
MKS2__000212.LAB	4/23/2019 12:00	1,339	0.126	13.0	0.0829	36.5	0.976
MKS2__000213.LAB	4/23/2019 12:02	1,208	0.125	13.2	0.0875	36.5	0.977
MKS2__000214.LAB	4/23/2019 12:04	639	0.122	13.3	0.0750	36.5	0.977
MKS2__000215.LAB	4/23/2019 12:06	950	0.117	13.4	0.0854	36.5	0.978
MKS2__000216.LAB	4/23/2019 12:08	712	0.114	13.5	0.0935	36.5	0.978
MKS2__000217.LAB	4/23/2019 12:11	412	0.113	13.5	0.0866	36.5	0.978
MKS2__000218.LAB	4/23/2019 12:13	233	0.113	13.6	0.0796	36.5	0.978
MKS2__000219.LAB	4/23/2019 12:15	133	0.114	13.7	0.0732	36.5	0.978
MKS2__000220.LAB	4/23/2019 12:17	75.8	0.113	13.7	0.0651	36.5	0.978
MKS2__000221.LAB	4/23/2019 12:19	45.4	0.112	13.9	0	36.5	0.977
MKS2__000222.LAB	4/23/2019 12:21	31.0	0.108	14.0	0	36.5	0.976
MKS2__000223.LAB	4/23/2019 12:23	21.8	0.102	14.2	0.0603	36.5	0.975
MKS2__000224.LAB	4/23/2019 12:25	13.3	0.0982	14.5	0.0602	36.4	0.974
MKS2__000225.LAB	4/23/2019 12:27	9.57	0.113	13.7	0.0604	36.4	0.974
MKS2__000226.LAB	4/23/2019 12:29	19.7	0.376	0	0.205	36.4	0.973
MKS2__000227.LAB	4/23/2019 12:32	16.6	0.384	0	0.207	36.4	0.973
MKS2__000228.LAB	4/23/2019 12:34	14.4	0.386	0	0.197	36.4	0.972
MKS2__000229.LAB	4/23/2019 12:36	12.8	0.386	0	0.196	36.4	0.972
MKS2__000230.LAB	4/23/2019 12:38	11.2	0.378	0	0.227	36.4	0.973
MKS2__000231.LAB	4/23/2019 12:40	9.78	0.377	0	0.237	36.4	0.973
MKS2__000232.LAB	4/23/2019 12:42	8.79	0.377	0	0.234	36.4	0.973
MKS2__000233.LAB	4/23/2019 12:44	8.05	0.378	0	0.226	36.4	0.973
MKS2__000234.LAB	4/23/2019 12:46	7.59	0.385	0	0.211	36.3	0.971
MKS2__000235.LAB	4/23/2019 12:48	7.45	0.388	0	0.202	36.4	0.971
MKS2__000236.LAB	4/23/2019 12:50	7.13	0.389	0	0.200	36.3	0.970
MKS2__000237.LAB	4/23/2019 12:52	7.83	0.382	0	0.223	36.3	0.970
MKS2__000238.LAB	4/23/2019 12:55	7.02	0.378	0	0.230	36.3	0.970
MKS2__000239.LAB	4/23/2019 12:57	6.53	0.378	0	0.230	36.3	0.970
MKS2__000240.LAB	4/23/2019 12:59	6.17	0.378	0	0.230	36.3	0.971

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000241.LAB	4/23/2019 13:01	6.33	0.384	0	0.217	36.3	0.971
MKS2__000242.LAB	4/23/2019 13:03	6.11	0.387	0	0.202	36.4	0.971
MKS2__000243.LAB	4/23/2019 13:05	6.20	0.388	0	0.192	36.3	0.971
MKS2__000244.LAB	4/23/2019 13:07	6.48	0.381	0	0.211	36.3	0.971
MKS2__000245.LAB	4/23/2019 13:09	6.41	0.379	0	0.230	36.3	0.971
MKS2__000246.LAB	4/23/2019 13:11	6.36	0.380	0	0.237	36.3	0.970
MKS2__000247.LAB	4/23/2019 13:13	6.68	0.380	0	0.238	36.2	0.970
MKS2__000248.LAB	4/23/2019 13:15	6.50	0.380	0	0.234	36.3	0.969
MKS2__000249.LAB	4/23/2019 13:18	6.56	0.381	0	0.234	36.3	0.969
MKS2__000250.LAB	4/23/2019 13:20	6.42	0.383	0	0.237	36.3	0.969
MKS2__000251.LAB	4/23/2019 13:22	7.08	0.417	0	0.227	36.3	0.968
MKS2__000252BKG.LAB	4/23/2019 13:29	0	0	0	0	36.3	0.968
MKS2__000253.LAB	4/23/2019 13:29	0	0	0	0	36.3	0.968
MKS2__000254.LAB	4/23/2019 13:29	0	0	0	0	36.3	0.968
MKS2__000255.LAB	4/23/2019 13:30	0	0	0	0	36.3	0.968
MKS2__000256.LAB	4/23/2019 13:30	0	0	0	0	36.3	0.968
MKS2__000257.LAB	4/23/2019 13:32	0	0	20.0	0	36.3	0.968
MKS2__000258.LAB	4/23/2019 13:32	0	0	19.9	0	36.3	0.968
MKS2__000259.LAB	4/23/2019 13:32	0	0	20.1	0	36.3	0.968
MKS2__000260.LAB	4/23/2019 13:32	0	0	20.0	0	36.3	0.968
MKS2__000261.LAB	4/23/2019 13:33	0	0	20.0	0	36.3	0.968
MKS2__000262.LAB	4/23/2019 13:33	1.18	0	20.0	0	36.3	0.968
MKS2__000263.LAB	4/23/2019 13:37	0	0	18.9	0	36.3	0.967
MKS2__000264.LAB	4/23/2019 13:39	0	0.0303	18.3	0	36.3	0.966
MKS2__000265.LAB	4/23/2019 13:41	0	0.0242	18.6	0	36.3	0.966
MKS2__000266.LAB	4/23/2019 13:43	0	0.102	15.0	0	36.3	0.965
MKS2__000267.LAB	4/23/2019 13:46	0.912	0.136	13.5	0	36.2	0.964
MKS2__000268.LAB	4/23/2019 13:48	0.775	0.128	13.9	0	36.2	0.964
MKS2__000269.LAB	4/23/2019 13:50	1.15	0.116	14.2	0	36.2	0.964
MKS2__000270.LAB	4/23/2019 13:52	0.810	0.0981	14.6	0	36.2	0.964

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000271.LAB	4/23/2019 13:54	0	0.0924	14.9	0	36.2	0.964
MKS2__000272.LAB	4/23/2019 13:56	0.918	0.0918	15.0	0	36.2	0.963
MKS2__000273.LAB	4/23/2019 13:58	0	0.0876	15.3	0	36.1	0.961
MKS2__000274.LAB	4/23/2019 14:00	0	0.0828	15.6	0	36.1	0.961
MKS2__000275.LAB	4/23/2019 14:02	0	0.0790	15.8	0	36.1	0.960
MKS2__000276.LAB	4/23/2019 14:04	0	0.0823	16.1	0	36.1	0.960
MKS2__000277.LAB	4/23/2019 14:06	0	0.0781	16.2	0	36.1	0.960
MKS2__000278.LAB	4/23/2019 14:09	0	0.0693	16.5	0	36.1	0.960
MKS2__000279.LAB	4/23/2019 14:11	0	0.0668	16.8	0	36.1	0.959
MKS2__000280.LAB	4/23/2019 14:13	0	0.148	13.0	0	36.1	0.958
MKS2__000281.LAB	4/23/2019 14:15	1,694	0.0880	13.3	0	36.1	0.959
MKS2__000282.LAB	4/23/2019 14:17	17,162	0	12.9	0	36.1	0.959
MKS2__000283.LAB	4/23/2019 14:19	9,057	0	13.3	0	36.0	0.957
MKS2__000284.LAB	4/23/2019 14:21	2,654	0.102	13.6	0.0668	36.1	0.957
MKS2__000285.LAB	4/23/2019 14:23	1,762	0.114	13.6	0.0698	36.0	0.958
MKS2__000286.LAB	4/23/2019 14:25	893	0.124	13.8	0.0683	36.0	0.958
MKS2__000287.LAB	4/23/2019 14:27	1,200	0.115	13.9	0.0701	36.0	0.958
MKS2__000288.LAB	4/23/2019 14:29	1,204	0.117	13.9	0.0747	36.0	0.957
MKS2__000289.LAB	4/23/2019 14:32	628	0.114	14.1	0.0622	36.0	0.957
MKS2__000290.LAB	4/23/2019 14:34	839	0.109	14.2	0.0695	36.0	0.957
MKS2__000291.LAB	4/23/2019 14:36	693	0.108	14.3	0.0812	36.0	0.955
MKS2__000292.LAB	4/23/2019 14:38	401	0.108	14.3	0.0785	36.0	0.954
MKS2__000293.LAB	4/23/2019 14:40	225	0.105	14.4	0.0715	35.9	0.954
MKS2__000294.LAB	4/23/2019 14:42	130	0.106	14.4	0.0638	35.9	0.954
MKS2__000295.LAB	4/23/2019 14:44	76.5	0.107	14.5	0	35.9	0.955
MKS2__000296.LAB	4/23/2019 14:46	46.8	0.108	14.5	0	36.0	0.955
MKS2__000297.LAB	4/23/2019 14:48	30.4	0.105	14.6	0	35.9	0.955
MKS2__000298.LAB	4/23/2019 14:50	22.5	0.101	14.7	0	35.9	0.955
MKS2__000299.LAB	4/23/2019 14:52	20.3	0.170	10.9	0.0834	35.9	0.954
MKS2__000300.LAB	4/23/2019 14:55	30.2	0.384	0	0.225	35.9	0.955

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000301.LAB	4/23/2019 14:57	21.8	0.386	0	0.227	35.9	0.954
MKS2__000302.LAB	4/23/2019 14:59	18.7	0.394	0	0.216	35.9	0.953
MKS2__000303.LAB	4/23/2019 15:01	14.9	0.398	0	0.208	35.9	0.953
MKS2__000304.LAB	4/23/2019 15:03	13.3	0.397	0	0.202	35.9	0.952
MKS2__000305.LAB	4/23/2019 15:05	11.3	0.388	0	0.226	35.9	0.955
MKS2__000306.LAB	4/23/2019 15:07	9.46	0.383	0	0.234	36.0	0.962
MKS2__000307.LAB	4/23/2019 15:09	8.11	0.380	0	0.235	35.9	0.968
MKS2__000308.LAB	4/23/2019 15:11	7.39	0.379	0	0.230	36.0	0.973
MKS2__000309.LAB	4/23/2019 15:13	7.22	0.383	0	0.208	36.0	0.975
MKS2__000310.LAB	4/23/2019 15:16	6.64	0.387	0	0.194	35.9	0.974
MKS2__000311.LAB	4/23/2019 15:18	6.70	0.388	0	0.190	36.0	0.976
MKS2__000312.LAB	4/23/2019 15:20	6.43	0.381	0	0.218	36.0	0.976
MKS2__000313.LAB	4/23/2019 15:22	6.27	0.377	0	0.232	36.0	0.979
MKS2__000314.LAB	4/23/2019 15:24	5.52	0.373	0	0.227	36.0	0.986
MKS2__000315.LAB	4/23/2019 15:26	5.46	0.372	0	0.220	36.0	0.988
MKS2__000316.LAB	4/23/2019 15:28	4.90	0.379	0	0.206	36.0	0.984
MKS2__000317.LAB	4/23/2019 15:30	5.28	0.384	0	0.197	36.0	0.985
MKS2__000318.LAB	4/23/2019 15:32	5.09	0.385	0	0.195	36.0	0.984
MKS2__000319.LAB	4/23/2019 15:52	1.29	0	0	0	36.0	0.981
MKS2__000320.LAB	4/23/2019 15:52	0	0	0	0	36.0	0.982
MKS2__000321.LAB	4/23/2019 15:53	1.92	0	0	0	36.0	0.982
MKS2__000322.LAB	4/23/2019 15:53	1.89	0	0	0	36.0	0.982
MKS2__000323.LAB	4/23/2019 15:53	1.23	0	0	0	36.1	0.982
MKS2__000324.LAB	4/23/2019 15:53	0	0	0	0	36.1	0.983
MKS2__000325.LAB	4/23/2019 15:54	0	0	0	0	36.1	0.983
MKS2__000326.LAB	4/23/2019 15:54	0	0	0	0	36.1	0.984
MKS2__000327.LAB	4/23/2019 15:54	1.40	0	0	0	36.1	0.985
MKS2__000328.LAB	4/23/2019 15:54	3.70	0	0	0	36.1	0.985
MKS2__000329.LAB	4/23/2019 15:55	4.46	0	0	0	36.1	0.986
MKS2__000330.LAB	4/23/2019 15:55	2.92	0	0	0	36.1	0.988

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000331.LAB	4/23/2019 15:55	3.03	0	0	0	36.1	0.989
MKS2__000332.LAB	4/23/2019 15:55	2.89	0	0	0	36.1	0.991
MKS2__000333BKG.LAB	4/23/2019 15:58	0	0	0	0	36.1	0.992
MKS2__000334.LAB	4/23/2019 16:00	0	0	19.7	0	36.1	0.991
MKS2__000335.LAB	4/23/2019 16:00	0	0	19.7	0	36.1	0.991
MKS2__000336.LAB	4/23/2019 16:00	0	0	19.6	0	36.1	0.991
MKS2__000337.LAB	4/23/2019 16:00	0	0	19.5	0	36.1	0.991
MKS2__000338.LAB	4/23/2019 16:01	0	0	19.5	0	36.1	0.990
MKS2__000339.LAB	4/23/2019 16:02	0	4.93	0.515	0	36.0	0.991
MKS2__000340.LAB	4/23/2019 16:02	0	4.95	0.358	0	36.0	0.990
MKS2__000341.LAB	4/23/2019 16:02	0	4.95	0.438	0	36.0	0.990
MKS2__000342.LAB	4/23/2019 16:03	0	4.96	0.309	0	36.1	0.990
MKS2__000343.LAB	4/23/2019 16:03	0	4.96	0.337	0	36.1	0.990
MKS2__000344.LAB	4/23/2019 16:03	0	4.94	0.558	0	36.1	0.990
MKS2__000345.LAB	4/23/2019 16:08	1.29	0	0	0.178	36.1	0.596
MKS2__000346.LAB	4/23/2019 16:09	1.01	0	0	0.176	36.1	0.598
MKS2__000347.LAB	4/23/2019 16:09	0	0	0	0.174	36.1	0.599
MKS2__000348.LAB	4/23/2019 16:09	0	0	0	0.172	36.1	0.601
MKS2__000349.LAB	4/23/2019 16:09	0	0	0	0.170	36.1	0.603
MKS2__000350.LAB	4/23/2019 16:10	0	0	0	0.168	36.1	0.605
MKS2__000351.LAB	4/23/2019 16:10	1.02	0	0	0.167	36.1	0.606
MKS2__000352.LAB	4/23/2019 16:10	0	0	0	0.166	36.1	0.607
MKS2__000353.LAB	4/23/2019 16:11	0.930	0	0	0.165	36.0	0.609
MKS2__000354.LAB	4/23/2019 16:11	1.29	0	0	0.164	36.0	0.610
MKS2__000355.LAB	4/23/2019 16:11	0	0	0	0.163	36.0	0.612
MKS2__000356.LAB	4/23/2019 16:11	0	0	0	0.162	36.0	0.613
MKS2__000357.LAB	4/23/2019 16:12	1.23	0	0	0.161	36.0	0.615
MKS2__000358.LAB	4/23/2019 16:12	0.870	0	0	0.160	36.1	0.616
MKS2__000359.LAB	4/23/2019 16:12	0	0	0	0.160	36.0	0.617
MKS2__000360.LAB	4/23/2019 16:12	0	0	0	0.158	36.1	0.619

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS2__000361.LAB	4/23/2019 16:13	1.99	0	0	0.158	36.0	0.621
MKS2__000362.LAB	4/23/2019 16:13	0	0	0	0.157	36.0	0.622
MKS2__000363.LAB	4/23/2019 16:13	0	0	0	0.156	36.0	0.623
MKS2__000364.LAB	4/23/2019 16:13	1.10	0	0	0.156	36.0	0.624
MKS2__000365.LAB	4/23/2019 16:16	8.97	0	0	0.155	36.0	1.15
MKS2__000366.LAB	4/23/2019 16:16	8.72	0	0	0.155	36.0	1.13
MKS2__000367.LAB	4/23/2019 16:16	9.98	0	0	0.154	36.0	1.11
MKS2__000368.LAB	4/23/2019 16:16	8.41	0	0	0.153	36.0	1.10
MKS2__000369.LAB	4/23/2019 16:17	7.10	0	0	0.153	36.0	1.08
MKS2__000370.LAB	4/23/2019 16:17	6.37	0	0	0.153	36.0	1.07
MKS2__000371.LAB	4/23/2019 16:17	7.66	0	0	0.153	36.0	1.06
MKS2__000372.LAB	4/23/2019 16:18	10.0	0	0	0.154	36.0	1.04
MKS2__000373.LAB	4/23/2019 16:18	7.34	0	0	0.154	36.0	1.03
MKS2__000374.LAB	4/23/2019 16:18	7.80	0	0	0.155	36.0	1.06
MKS2__000375.LAB	4/23/2019 16:19	8.86	0	0	0.153	35.9	1.12
MKS2__000376.LAB	4/23/2019 16:19	8.71	0	0	0.153	35.9	1.11
MKS2__000377.LAB	4/23/2019 16:20	7.95	0	0	0.153	35.9	1.11
MKS2__000378.LAB	4/23/2019 16:20	7.61	0	0	0.153	36.0	1.11
MKS2__000379.LAB	4/23/2019 16:20	8.40	0	0	0.153	35.9	1.10
MKS2__000380.LAB	4/23/2019 16:20	8.28	0	0	0.153	36.0	1.10
MKS2__000381.LAB	4/23/2019 16:21	8.54	0	0	0.153	36.0	1.10
MKS2__000382.LAB	4/23/2019 16:21	7.80	0	0	0.152	36.0	1.09
MKS2__000383.LAB	4/23/2019 16:21	8.40	0	0	0.152	35.9	1.09

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000001.LAB	4/23/2019 6:52	224	0	1.07
MKS2__000002.LAB	4/23/2019 6:53	225	0	1.08
MKS2__000003.LAB	4/23/2019 6:54	226	0	1.08
MKS2__000004.LAB	4/23/2019 6:55	226	0	1.09
MKS2__000005.LAB	4/23/2019 6:56	227	0	1.09
MKS2__000006.LAB	4/23/2019 6:57	227	0	1.09
MKS2__000007.LAB	4/23/2019 6:58	226	0	1.09
MKS2__000008.LAB	4/23/2019 6:59	226	0	1.09
MKS2__000009.LAB	4/23/2019 7:02	118	0	0.913
MKS2__000010.LAB	4/23/2019 7:03	121	0	0.904
MKS2__000011.LAB	4/23/2019 7:04	124	0	0.894
MKS2__000012.LAB	4/23/2019 7:05	127	0	0.888
MKS2__000013.LAB	4/23/2019 7:15	114	0	0.811
MKS2__000014.LAB	4/23/2019 7:16	116	0	0.807
MKS2__000015.LAB	4/23/2019 7:17	122	0	0.807
MKS2__000016.LAB	4/23/2019 7:19	130	0	0.817
MKS2__000017.LAB	4/23/2019 7:20	138	0	0.828
MKS2__000018.LAB	4/23/2019 7:34	202	0	0.923
MKS2__000019.LAB	4/23/2019 7:35	197	0	0.895
MKS2__000020.LAB	4/23/2019 7:36	195	0	0.870
MKS2__000021.LAB	4/23/2019 7:37	192	0	0.846
MKS2__000022.LAB	4/23/2019 7:38	188	0	0.825
MKS2__000023.LAB	4/23/2019 7:41	117	0	0.747
MKS2__000024.LAB	4/23/2019 7:42	119	0	0.743
MKS2__000025.LAB	4/23/2019 7:43	122	0	0.741
MKS2__000026.LAB	4/23/2019 7:44	123	0	0.740
MKS2__000027.LAB	4/23/2019 7:45	125	0	0.741
MKS2__000028BKG.LAB	4/23/2019 7:55	0	0	0
MKS2__000029.LAB	4/23/2019 7:56	0	0	0
MKS2__000030BKG.LAB	4/23/2019 7:59	0	0	0

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000031BKG.LAB	4/23/2019 8:01	0	0	0
MKS2__000032.LAB	4/23/2019 8:02	0	0	0
MKS2__000033BKG.LAB	4/23/2019 8:04	0	0	0
MKS2__000034.LAB	4/23/2019 8:07	0	0	0
MKS2__000035.LAB	4/23/2019 8:07	0	0	0
MKS2__000036.LAB	4/23/2019 8:08	0	0	0
MKS2__000037.LAB	4/23/2019 8:08	0	0	0
MKS2__000038.LAB	4/23/2019 8:09	0	0	0
MKS2__000039.LAB	4/23/2019 8:09	0	0	0
MKS2__000040.LAB	4/23/2019 8:10	0	0	0
MKS2__000041.LAB	4/23/2019 8:10	0	0	0
MKS2__000042.LAB	4/23/2019 8:10	0	0	0
MKS2__000043.LAB	4/23/2019 8:12	1.31	0	0
MKS2__000044.LAB	4/23/2019 8:12	9.81	0	0
MKS2__000045.LAB	4/23/2019 8:12	26.6	0	0
MKS2__000046.LAB	4/23/2019 8:13	35.4	0.0572	0
MKS2__000047.LAB	4/23/2019 8:13	41.3	0.0602	0
MKS2__000048.LAB	4/23/2019 8:13	46.0	0.0646	0
MKS2__000049.LAB	4/23/2019 8:13	50.5	0.0629	0
MKS2__000050.LAB	4/23/2019 8:14	55.6	0.0600	0
MKS2__000051.LAB	4/23/2019 8:14	59.2	0.0575	0
MKS2__000052.LAB	4/23/2019 8:14	62.5	0.0584	0
MKS2__000053.LAB	4/23/2019 8:14	68.2	0.0386	0
MKS2__000054.LAB	4/23/2019 8:15	83.9	0	0
MKS2__000055.LAB	4/23/2019 8:15	87.3	0	0
MKS2__000056.LAB	4/23/2019 8:15	88.2	0	0
MKS2__000057.LAB	4/23/2019 8:16	87.5	0	0
MKS2__000058.LAB	4/23/2019 8:16	91.2	0	0
MKS2__000059.LAB	4/23/2019 8:16	92.6	0	0
MKS2__000060.LAB	4/23/2019 8:16	92.9	0	0

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000061.LAB	4/23/2019 8:17	92.9	0	0
MKS2__000062.LAB	4/23/2019 8:17	94.6	0	0
MKS2__000063.LAB	4/23/2019 8:17	95.1	0	0
MKS2__000064.LAB	4/23/2019 8:17	94.8	0	0
MKS2__000065.LAB	4/23/2019 8:18	96.3	0	0
MKS2__000066.LAB	4/23/2019 8:18	98.0	0	0
MKS2__000067.LAB	4/23/2019 8:18	98.4	0	0
MKS2__000068.LAB	4/23/2019 8:18	98.1	0	0
MKS2__000069.LAB	4/23/2019 8:19	97.7	0	0
MKS2__000070.LAB	4/23/2019 8:19	98.9	0	0
MKS2__000071.LAB	4/23/2019 8:19	98.2	0	0
MKS2__000072.LAB	4/23/2019 8:20	99.9	0	0
MKS2__000073.LAB	4/23/2019 8:20	100	0	0
MKS2__000074.LAB	4/23/2019 8:35	1.28	0.411	0.213
MKS2__000075.LAB	4/23/2019 8:37	0	0.412	0.212
MKS2__000076.LAB	4/23/2019 8:37	1.74	0.411	0.210
MKS2__000077.LAB	4/23/2019 8:37	0	0.409	0.212
MKS2__000078.LAB	4/23/2019 8:38	2.96	0.402	0.311
MKS2__000079.LAB	4/23/2019 8:38	10.1	0.368	0.625
MKS2__000080.LAB	4/23/2019 8:38	54.2	0.378	1.55
MKS2__000081.LAB	4/23/2019 8:38	18.2	0.329	0.636
MKS2__000082.LAB	4/23/2019 8:39	3.01	0.387	0.236
MKS2__000083.LAB	4/23/2019 8:39	3.35	0.373	0.227
MKS2__000084.LAB	4/23/2019 8:39	1.50	0.384	0.225
MKS2__000085.LAB	4/23/2019 8:39	3.14	0.392	0.186
MKS2__000086.LAB	4/23/2019 8:40	3.39	0.400	0.145
MKS2__000087.LAB	4/23/2019 8:40	4.86	0.398	0.166
MKS2__000088.LAB	4/23/2019 8:40	10.1	0.405	0.184
MKS2__000089.LAB	4/23/2019 8:40	6.29	0.401	0.186
MKS2__000090.LAB	4/23/2019 8:41	4.58	0.403	0.193

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000091.LAB	4/23/2019 8:41	4.86	0.403	0.199
MKS2__000092.LAB	4/23/2019 8:41	15.7	0.374	0.381
MKS2__000093.LAB	4/23/2019 8:41	2.22	0.365	0.379
MKS2__000094.LAB	4/23/2019 8:42	13.9	0.370	0.347
MKS2__000095.LAB	4/23/2019 8:42	9.60	0.356	0.306
MKS2__000096.LAB	4/23/2019 8:42	3.08	0.356	0.277
MKS2__000097.LAB	4/23/2019 8:42	0	0.381	0.238
MKS2__000098.LAB	4/23/2019 8:43	0	0.364	0.225
MKS2__000099.LAB	4/23/2019 8:43	11.1	0.365	0.205
MKS2__000100.LAB	4/23/2019 8:43	0	0.369	0.192
MKS2__000101.LAB	4/23/2019 8:44	0	0.360	0.187
MKS2__000102.LAB	4/23/2019 8:44	13.1	0.366	0.179
MKS2__000103.LAB	4/23/2019 8:44	0.630	0.362	0.188
MKS2__000104.LAB	4/23/2019 8:44	7.02	0.356	0.191
MKS2__000105.LAB	4/23/2019 8:45	0	0.368	0.179
MKS2__000106.LAB	4/23/2019 8:45	9.34	0.369	0.173
MKS2__000107.LAB	4/23/2019 8:45	0	0.389	0.179
MKS2__000108.LAB	4/23/2019 8:45	0	0.375	0.184
MKS2__000109.LAB	4/23/2019 8:46	0	0.384	0.162
MKS2__000110.LAB	4/23/2019 8:46	1.64	0.397	0
MKS2__000111.LAB	4/23/2019 8:46	0	0.377	0.149
MKS2__000112.LAB	4/23/2019 8:46	0	0.373	0.257
MKS2__000113.LAB	4/23/2019 8:47	0	0.369	0.244
MKS2__000114.LAB	4/23/2019 8:47	0	0.374	0.224
MKS2__000115.LAB	4/23/2019 8:47	0	0.369	0.171
MKS2__000116.LAB	4/23/2019 8:47	0	0.396	0.0925
MKS2__000117.LAB	4/23/2019 8:48	0	0.393	0.112
MKS2__000118.LAB	4/23/2019 8:48	0	0.399	0.141
MKS2__000119.LAB	4/23/2019 8:48	0	0.400	0.157
MKS2__000120.LAB	4/23/2019 8:48	0	0.395	0.167

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000121.LAB	4/23/2019 8:49	0	0.395	0.170
MKS2__000122.LAB	4/23/2019 8:51	0	0.397	0.186
MKS2__000123.LAB	4/23/2019 8:53	0	0.401	0.186
MKS2__000124.LAB	4/23/2019 8:56	1.22	0.392	0.181
MKS2__000125.LAB	4/23/2019 8:58	0	0.393	0.177
MKS2__000126.LAB	4/23/2019 9:00	14.5	0.361	0.186
MKS2__000127.LAB	4/23/2019 9:02	60.8	0.344	0.190
MKS2__000128.LAB	4/23/2019 9:04	2.87	0.342	0.194
MKS2__000129.LAB	4/23/2019 9:06	15.3	0.338	0.202
MKS2__000130.LAB	4/23/2019 9:08	203	0.337	0.178
MKS2__000131.LAB	4/23/2019 9:10	100	0.338	0.197
MKS2__000132.LAB	4/23/2019 9:12	44.2	0.342	0.181
MKS2__000133.LAB	4/23/2019 9:14	25.1	0.340	0.190
MKS2__000134.LAB	4/23/2019 9:16	15.6	0.324	0.157
MKS2__000135.LAB	4/23/2019 9:19	25.3	0.384	0.139
MKS2__000136.LAB	4/23/2019 9:21	20.5	0.395	0.176
MKS2__000137.LAB	4/23/2019 9:23	10.5	0.374	0.212
MKS2__000138.LAB	4/23/2019 9:25	25.2	0.384	0.221
MKS2__000139.LAB	4/23/2019 9:27	10.8	0.402	0.178
MKS2__000140.LAB	4/23/2019 9:29	16,638	**0**	0.105
MKS2__000141.LAB	4/23/2019 9:31	40,478	**0**	0.234
MKS2__000142.LAB	4/23/2019 9:33	11,105	**0.265**	0.218
MKS2__000143.LAB	4/23/2019 9:35	5,807	0.340	0.226
MKS2__000144.LAB	4/23/2019 9:38	4,962	0.357	0.215
MKS2__000145.LAB	4/23/2019 9:40	2,756	0.368	0.203
MKS2__000146.LAB	4/23/2019 9:42	4,079	0.340	0.205
MKS2__000147.LAB	4/23/2019 9:44	3,637	0.340	0.219
MKS2__000148.LAB	4/23/2019 9:46	1,864	0.340	0.190
MKS2__000149.LAB	4/23/2019 9:48	3,067	0.332	0.191
MKS2__000150.LAB	4/23/2019 9:50	2,143	0.327	0.214

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000151.LAB	4/23/2019 9:52	1,207	0.320	0.206
MKS2__000152.LAB	4/23/2019 9:54	692	0.327	0.196
MKS2__000153.LAB	4/23/2019 9:56	379	0.345	0.163
MKS2__000154.LAB	4/23/2019 9:58	220	0.356	0.176
MKS2__000155.LAB	4/23/2019 10:01	129	0.356	0.161
MKS2__000156.LAB	4/23/2019 10:03	88.2	0.344	0.155
MKS2__000157.LAB	4/23/2019 10:05	56.5	0.348	0.181
MKS2__000158.LAB	4/23/2019 10:07	32.3	0.338	0.191
MKS2__000159.LAB	4/23/2019 10:09	15.8	0.345	0.188
MKS2__000160.LAB	4/23/2019 10:11	5.85	0.353	0.180
MKS2__000161.LAB	4/23/2019 10:13	0	0.353	0.162
MKS2__000162.LAB	4/23/2019 10:15	0.576	0.354	0.150
MKS2__000163.LAB	4/23/2019 10:17	0	0.354	0.147
MKS2__000164.LAB	4/23/2019 10:19	0	0.349	0.165
MKS2__000165.LAB	4/23/2019 10:22	92.5	0.338	0.170
MKS2__000166.LAB	4/23/2019 10:24	1.72	0.344	0.175
MKS2__000167.LAB	4/23/2019 10:26	0	0.347	0.175
MKS2__000168.LAB	4/23/2019 10:28	0	0.353	0.166
MKS2__000169.LAB	4/23/2019 10:30	0	0.367	0.140
MKS2__000170.LAB	4/23/2019 10:32	0	0.369	0.167
MKS2__000171.LAB	4/23/2019 10:34	0	0.356	0.191
MKS2__000172.LAB	4/23/2019 10:36	0	0.356	0.203
MKS2__000173.LAB	4/23/2019 10:38	0	0.350	0.207
MKS2__000174.LAB	4/23/2019 10:40	0	0.352	0.201
MKS2__000175.LAB	4/23/2019 10:42	0	0.359	0.185
MKS2__000176.LAB	4/23/2019 10:45	0	0.361	0.171
MKS2__000177.LAB	4/23/2019 10:47	0	0.365	0.136
MKS2__000178.LAB	4/23/2019 10:49	0	0.373	0.193
MKS2__000179.LAB	4/23/2019 10:51	0	0.372	0.230
MKS2__000180.LAB	4/23/2019 10:53	0	0.371	0.231

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000181.LAB	4/23/2019 10:55	0	0.374	0.229
MKS2__000182.LAB	4/23/2019 10:57	0.516	0.376	0.231
MKS2__000183.LAB	4/23/2019 10:59	0	0.375	0.235
MKS2__000184.LAB	4/23/2019 11:01	0	0.376	0.239
MKS2__000185BKG.LAB	4/23/2019 11:12	0	0	0
MKS2__000186.LAB	4/23/2019 11:14	0.749	0	0
MKS2__000187.LAB	4/23/2019 11:14	1.14	0	0
MKS2__000188.LAB	4/23/2019 11:14	1.52	0	0
MKS2__000189.LAB	4/23/2019 11:15	1.99	0	0
MKS2__000190.LAB	4/23/2019 11:15	1.75	0	0
MKS2__000191.LAB	4/23/2019 11:15	0	0	0
MKS2__000192.LAB	4/23/2019 11:15	0.730	0	0
MKS2__000193.LAB	4/23/2019 11:20	8.88	0.402	0.191
MKS2__000194.LAB	4/23/2019 11:22	6.72	0.385	0.194
MKS2__000195.LAB	4/23/2019 11:25	7.49	0.352	0.215
MKS2__000196.LAB	4/23/2019 11:27	6.38	0.352	0.217
MKS2__000197.LAB	4/23/2019 11:29	3.55	0.350	0.206
MKS2__000198.LAB	4/23/2019 11:31	6.25	0.369	0.184
MKS2__000199.LAB	4/23/2019 11:33	6.82	0.373	0.195
MKS2__000200.LAB	4/23/2019 11:35	6.50	0.382	0.188
MKS2__000201.LAB	4/23/2019 11:37	6.80	0.416	0.182
MKS2__000202.LAB	4/23/2019 11:39	7.53	0.397	0.189
MKS2__000203.LAB	4/23/2019 11:41	6.74	0.391	0.245
MKS2__000204.LAB	4/23/2019 11:43	7.30	0.416	0.199
MKS2__000205.LAB	4/23/2019 11:45	5.84	0.418	0.190
MKS2__000206.LAB	4/23/2019 11:48	27,328	**0**	0
MKS2__000207.LAB	4/23/2019 11:50	36,810	**0.138**	0.208
MKS2__000208.LAB	4/23/2019 11:52	10,614	**0.270**	0.224
MKS2__000209.LAB	4/23/2019 11:54	5,593	0.362	0.251
MKS2__000210.LAB	4/23/2019 11:56	3,450	0.390	0.246

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000211.LAB	4/23/2019 11:58	2,659	0.392	0.233
MKS2__000212.LAB	4/23/2019 12:00	3,878	0.366	0.240
MKS2__000213.LAB	4/23/2019 12:02	3,607	0.374	0.261
MKS2__000214.LAB	4/23/2019 12:04	1,941	0.371	0.228
MKS2__000215.LAB	4/23/2019 12:06	2,953	0.363	0.265
MKS2__000216.LAB	4/23/2019 12:08	2,238	0.360	0.294
MKS2__000217.LAB	4/23/2019 12:11	1,295	0.357	0.273
MKS2__000218.LAB	4/23/2019 12:13	741	0.361	0.253
MKS2__000219.LAB	4/23/2019 12:15	428	0.367	0.236
MKS2__000220.LAB	4/23/2019 12:17	247	0.370	0.212
MKS2__000221.LAB	4/23/2019 12:19	151	0.373	0.198
MKS2__000222.LAB	4/23/2019 12:21	106	0.369	0.193
MKS2__000223.LAB	4/23/2019 12:23	77.4	0.361	0.214
MKS2__000224.LAB	4/23/2019 12:25	49.7	0.367	0.225
MKS2__000225.LAB	4/23/2019 12:27	30.9	0.365	0.195
MKS2__000226.LAB	4/23/2019 12:29	19.7	0.376	0.205
MKS2__000227.LAB	4/23/2019 12:32	16.6	0.384	0.207
MKS2__000228.LAB	4/23/2019 12:34	14.4	0.386	0.197
MKS2__000229.LAB	4/23/2019 12:36	12.8	0.386	0.196
MKS2__000230.LAB	4/23/2019 12:38	11.2	0.378	0.227
MKS2__000231.LAB	4/23/2019 12:40	9.78	0.377	0.237
MKS2__000232.LAB	4/23/2019 12:42	8.79	0.377	0.234
MKS2__000233.LAB	4/23/2019 12:44	8.05	0.378	0.226
MKS2__000234.LAB	4/23/2019 12:46	7.59	0.385	0.211
MKS2__000235.LAB	4/23/2019 12:48	7.45	0.388	0.202
MKS2__000236.LAB	4/23/2019 12:50	7.13	0.389	0.200
MKS2__000237.LAB	4/23/2019 12:52	7.83	0.382	0.223
MKS2__000238.LAB	4/23/2019 12:55	7.02	0.378	0.230
MKS2__000239.LAB	4/23/2019 12:57	6.53	0.378	0.230
MKS2__000240.LAB	4/23/2019 12:59	6.17	0.378	0.230

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000241.LAB	4/23/2019 13:01	6.33	0.384	0.217
MKS2__000242.LAB	4/23/2019 13:03	6.11	0.387	0.202
MKS2__000243.LAB	4/23/2019 13:05	6.20	0.388	0.192
MKS2__000244.LAB	4/23/2019 13:07	6.48	0.381	0.211
MKS2__000245.LAB	4/23/2019 13:09	6.41	0.379	0.230
MKS2__000246.LAB	4/23/2019 13:11	6.36	0.380	0.237
MKS2__000247.LAB	4/23/2019 13:13	6.68	0.380	0.238
MKS2__000248.LAB	4/23/2019 13:15	6.50	0.380	0.234
MKS2__000249.LAB	4/23/2019 13:18	6.56	0.381	0.234
MKS2__000250.LAB	4/23/2019 13:20	6.42	0.383	0.237
MKS2__000251.LAB	4/23/2019 13:22	7.08	0.417	0.227
MKS2__000252BKG.LAB	4/23/2019 13:29	0	0	0
MKS2__000253.LAB	4/23/2019 13:29	0	0	0
MKS2__000254.LAB	4/23/2019 13:29	0	0	0
MKS2__000255.LAB	4/23/2019 13:30	0	0	0
MKS2__000256.LAB	4/23/2019 13:30	0	0	0
MKS2__000257.LAB	4/23/2019 13:32	0	0	0
MKS2__000258.LAB	4/23/2019 13:32	0	0	0
MKS2__000259.LAB	4/23/2019 13:32	0	0	0
MKS2__000260.LAB	4/23/2019 13:32	0	0	0
MKS2__000261.LAB	4/23/2019 13:33	0	0	0
MKS2__000262.LAB	4/23/2019 13:33	1.18	0	0
MKS2__000263.LAB	4/23/2019 13:37	12.2	0.367	0.592
MKS2__000264.LAB	4/23/2019 13:39	1.11	0.411	0.161
MKS2__000265.LAB	4/23/2019 13:41	0	0.396	0.138
MKS2__000266.LAB	4/23/2019 13:43	0.787	0.419	0.110
MKS2__000267.LAB	4/23/2019 13:46	2.85	0.426	0.175
MKS2__000268.LAB	4/23/2019 13:48	2.59	0.428	0.178
MKS2__000269.LAB	4/23/2019 13:50	4.09	0.412	0.181
MKS2__000270.LAB	4/23/2019 13:52	3.11	0.376	0.206

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000271.LAB	4/23/2019 13:54	2.41	0.376	0.211
MKS2__000272.LAB	4/23/2019 13:56	3.81	0.381	0.211
MKS2__000273.LAB	4/23/2019 13:58	1.28	0.385	0.200
MKS2__000274.LAB	4/23/2019 14:00	2.21	0.390	0.176
MKS2__000275.LAB	4/23/2019 14:02	0	0.394	0.166
MKS2__000276.LAB	4/23/2019 14:04	0	0.435	0.158
MKS2__000277.LAB	4/23/2019 14:06	1.43	0.425	0.156
MKS2__000278.LAB	4/23/2019 14:09	0	0.417	0.198
MKS2__000279.LAB	4/23/2019 14:11	0	0.441	0.191
MKS2__000280.LAB	4/23/2019 14:13	1.84	0.434	0.149
MKS2__000281.LAB	4/23/2019 14:15	5,154	**0.268**	0.166
MKS2__000282.LAB	4/23/2019 14:17	49,538	**0**	0.118
MKS2__000283.LAB	4/23/2019 14:19	27,766	**0**	0
MKS2__000284.LAB	4/23/2019 14:21	8,430	0.324	0.212
MKS2__000285.LAB	4/23/2019 14:23	5,659	0.367	0.224
MKS2__000286.LAB	4/23/2019 14:25	2,960	0.410	0.226
MKS2__000287.LAB	4/23/2019 14:27	4,040	0.386	0.236
MKS2__000288.LAB	4/23/2019 14:29	4,063	0.395	0.252
MKS2__000289.LAB	4/23/2019 14:32	2,172	0.394	0.215
MKS2__000290.LAB	4/23/2019 14:34	2,940	0.383	0.244
MKS2__000291.LAB	4/23/2019 14:36	2,476	0.384	0.290
MKS2__000292.LAB	4/23/2019 14:38	1,441	0.387	0.282
MKS2__000293.LAB	4/23/2019 14:40	826	0.386	0.262
MKS2__000294.LAB	4/23/2019 14:42	479	0.392	0.236
MKS2__000295.LAB	4/23/2019 14:44	283	0.397	0.206
MKS2__000296.LAB	4/23/2019 14:46	175	0.403	0.197
MKS2__000297.LAB	4/23/2019 14:48	116	0.402	0.200
MKS2__000298.LAB	4/23/2019 14:50	87.7	0.394	0.229
MKS2__000299.LAB	4/23/2019 14:52	45.4	0.380	0.186
MKS2__000300.LAB	4/23/2019 14:55	30.0	0.381	0.224

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000301.LAB	4/23/2019 14:57	21.6	0.384	0.225
MKS2__000302.LAB	4/23/2019 14:59	18.5	0.391	0.215
MKS2__000303.LAB	4/23/2019 15:01	14.8	0.396	0.206
MKS2__000304.LAB	4/23/2019 15:03	13.2	0.395	0.201
MKS2__000305.LAB	4/23/2019 15:05	11.2	0.385	0.224
MKS2__000306.LAB	4/23/2019 15:07	9.39	0.380	0.232
MKS2__000307.LAB	4/23/2019 15:09	8.06	0.377	0.234
MKS2__000308.LAB	4/23/2019 15:11	7.33	0.376	0.228
MKS2__000309.LAB	4/23/2019 15:13	7.17	0.381	0.207
MKS2__000310.LAB	4/23/2019 15:16	6.58	0.384	0.192
MKS2__000311.LAB	4/23/2019 15:18	6.65	0.385	0.189
MKS2__000312.LAB	4/23/2019 15:20	6.38	0.379	0.217
MKS2__000313.LAB	4/23/2019 15:22	6.22	0.374	0.230
MKS2__000314.LAB	4/23/2019 15:24	5.48	0.371	0.225
MKS2__000315.LAB	4/23/2019 15:26	5.43	0.370	0.218
MKS2__000316.LAB	4/23/2019 15:28	4.86	0.376	0.204
MKS2__000317.LAB	4/23/2019 15:30	5.26	0.382	0.196
MKS2__000318.LAB	4/23/2019 15:32	5.06	0.382	0.193
MKS2__000319.LAB	4/23/2019 15:52	1.29	0	0
MKS2__000320.LAB	4/23/2019 15:52	0	0	0
MKS2__000321.LAB	4/23/2019 15:53	1.92	0	0
MKS2__000322.LAB	4/23/2019 15:53	1.89	0	0
MKS2__000323.LAB	4/23/2019 15:53	1.22	0	0
MKS2__000324.LAB	4/23/2019 15:53	0	0	0
MKS2__000325.LAB	4/23/2019 15:54	0	0	0
MKS2__000326.LAB	4/23/2019 15:54	0	0	0
MKS2__000327.LAB	4/23/2019 15:54	1.40	0	0
MKS2__000328.LAB	4/23/2019 15:54	3.70	0	0
MKS2__000329.LAB	4/23/2019 15:55	4.45	0	0
MKS2__000330.LAB	4/23/2019 15:55	2.91	0	0

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000331.LAB	4/23/2019 15:55	3.02	0	0
MKS2__000332.LAB	4/23/2019 15:55	2.89	0	0
MKS2__000333BKG.LAB	4/23/2019 15:58	0	0	0
MKS2__000334.LAB	4/23/2019 16:00	0	0	0
MKS2__000335.LAB	4/23/2019 16:00	0	0	0
MKS2__000336.LAB	4/23/2019 16:00	0	0	0
MKS2__000337.LAB	4/23/2019 16:00	0	0	0
MKS2__000338.LAB	4/23/2019 16:01	0	0	0
MKS2__000339.LAB	4/23/2019 16:02	0	5.06	0
MKS2__000340.LAB	4/23/2019 16:02	0	5.04	0
MKS2__000341.LAB	4/23/2019 16:02	0	5.07	0
MKS2__000342.LAB	4/23/2019 16:03	0	5.04	0
MKS2__000343.LAB	4/23/2019 16:03	0	5.04	0
MKS2__000344.LAB	4/23/2019 16:03	0	5.09	0
MKS2__000345.LAB	4/23/2019 16:08	1.29	0	0.178
MKS2__000346.LAB	4/23/2019 16:09	1.01	0	0.176
MKS2__000347.LAB	4/23/2019 16:09	0	0	0.174
MKS2__000348.LAB	4/23/2019 16:09	0	0	0.171
MKS2__000349.LAB	4/23/2019 16:09	0	0	0.170
MKS2__000350.LAB	4/23/2019 16:10	0	0	0.168
MKS2__000351.LAB	4/23/2019 16:10	1.01	0	0.166
MKS2__000352.LAB	4/23/2019 16:10	0	0	0.165
MKS2__000353.LAB	4/23/2019 16:11	0.928	0	0.165
MKS2__000354.LAB	4/23/2019 16:11	1.30	0	0.164
MKS2__000355.LAB	4/23/2019 16:11	0	0	0.163
MKS2__000356.LAB	4/23/2019 16:11	0	0	0.162
MKS2__000357.LAB	4/23/2019 16:12	1.22	0	0.161
MKS2__000358.LAB	4/23/2019 16:12	0.869	0	0.160
MKS2__000359.LAB	4/23/2019 16:12	0	0	0.160
MKS2__000360.LAB	4/23/2019 16:12	0	0	0.158

File Name	Date/Time	DF Corrected Ethylene Oxide PPMv, Wet	DF Corrected Sulfur Hexa-fluoride PPMv, Wet	DF Corrected Water Vapor %v/v, Wet
MKS2__000361.LAB	4/23/2019 16:13	1.98	0	0.158
MKS2__000362.LAB	4/23/2019 16:13	0	0	0.157
MKS2__000363.LAB	4/23/2019 16:13	0	0	0.156
MKS2__000364.LAB	4/23/2019 16:13	1.10	0	0.156
MKS2__000365.LAB	4/23/2019 16:16	8.98	0	0.155
MKS2__000366.LAB	4/23/2019 16:16	8.72	0	0.155
MKS2__000367.LAB	4/23/2019 16:16	10.0	0	0.154
MKS2__000368.LAB	4/23/2019 16:16	8.41	0	0.154
MKS2__000369.LAB	4/23/2019 16:17	7.11	0	0.153
MKS2__000370.LAB	4/23/2019 16:17	6.38	0	0.153
MKS2__000371.LAB	4/23/2019 16:17	7.66	0	0.153
MKS2__000372.LAB	4/23/2019 16:18	10.1	0	0.154
MKS2__000373.LAB	4/23/2019 16:18	7.36	0	0.154
MKS2__000374.LAB	4/23/2019 16:18	7.83	0	0.156
MKS2__000375.LAB	4/23/2019 16:19	8.86	0	0.153
MKS2__000376.LAB	4/23/2019 16:19	8.74	0	0.153
MKS2__000377.LAB	4/23/2019 16:20	7.97	0	0.153
MKS2__000378.LAB	4/23/2019 16:20	7.63	0	0.153
MKS2__000379.LAB	4/23/2019 16:20	8.42	0	0.153
MKS2__000380.LAB	4/23/2019 16:20	8.29	0	0.153
MKS2__000381.LAB	4/23/2019 16:21	8.57	0	0.153
MKS2__000382.LAB	4/23/2019 16:21	7.81	0	0.152
MKS2__000383.LAB	4/23/2019 16:21	8.43	0	0.153

Appendix B

FTIR Spectral Log Attestation
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

System Identification:	MKS - Instrument MKS2
Test Start Date:	April 23, 2019
Test End Date:	April 23, 2019

No. of Target Constituents:	3
No. of FTIR Log Entries:	383

First Log Entry:	MKS2__000001.LAB	4/23/2019 6:52
Last Log Entry:	MKS2__000383.LAB	4/23/2019 16:21

The preceding log of collected FTIR spectra, as identified above, is a true and accurate record of instrument results contingent to the standardized instrument software and operator configured method maps. Instrument baseline 'noise' recorded below the QLs have been normalized to zero. No other adjustment to the raw instrument/software generated results have been made. I certify the log is a true record of the test results subject to the precision and accuracy of the method, matrix and instrumentation.

Brett D. Erickson

Note: Quantitation limits (QLs) are applied to the average results for the finalized report tables in accordance with regulatory guidelines and project objectives.

Appendix B

FTIR Spectral Log - Group 1 of 1
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

Final log entry is 4/23/19 16:22 Constituents 1 - 6 of 6

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0001.LAB	4/23/2019 6:48	24.3	0	0.268	1.30	36.5	0.226
MKS3__0002.LAB	4/23/2019 6:49	24.0	0	0	1.34	36.5	0.228
MKS3__0003.LAB	4/23/2019 6:50	24.0	0	0	1.36	36.5	0.229
MKS3__0004.LAB	4/23/2019 6:51	23.4	0	0	1.38	36.5	0.231
MKS3__0005.LAB	4/23/2019 7:00	3.20	0	0.301	0.959	36.6	1.21
MKS3__0006.LAB	4/23/2019 7:01	3.20	0	0.311	0.945	36.6	1.21
MKS3__0007.LAB	4/23/2019 7:02	3.19	0	0.306	0.936	36.6	1.20
MKS3__0008.LAB	4/23/2019 7:03	3.17	0	0.303	0.930	36.6	1.20
MKS3__0009BKG.LAB	4/23/2019 7:16	0	0	0	0	36.6	0.936
MKS3__0010.LAB	4/23/2019 7:17	0	0	0	0	36.6	0.936
MKS3__0011.LAB	4/23/2019 7:18	0	0	0	0	36.5	0.936
MKS3__0012BKG.LAB	4/23/2019 7:21	0	0	0	0	36.5	0.936
MKS3__0013.LAB	4/23/2019 7:23	0	0	0	0	36.6	0.936
MKS3__0014.LAB	4/23/2019 7:25	0	0	0	0	36.5	0.936
MKS3__0015.LAB	4/23/2019 7:27	0	0	0	0	36.5	0.936
MKS3__0016.LAB	4/23/2019 7:29	0	0	0	0	36.5	0.936
MKS3__0017.LAB	4/23/2019 7:31	0	0	0	0	36.6	0.935
MKS3__0018.LAB	4/23/2019 7:33	0	0	0	0	36.6	0.936
MKS3__0019BKG.LAB	4/23/2019 7:36	0	0	0	0	36.6	0.937
MKS3__0020.LAB	4/23/2019 7:38	0	0	0	0	36.5	0.936
MKS3__0021.LAB	4/23/2019 7:40	0	0	0	0	36.5	0.936
MKS3__0022.LAB	4/23/2019 7:42	0	0	0	0	36.6	0.936
MKS3__0023.LAB	4/23/2019 7:44	0	0	0	0	36.6	0.937
MKS3__0024BKG.LAB	4/23/2019 7:48	0	0	0	0	36.6	0.937
MKS3__0025.LAB	4/23/2019 7:50	0	0	0	0	36.5	0.937
MKS3__0026.LAB	4/23/2019 7:52	0	0	0	0	36.6	0.936
MKS3__0027.LAB	4/23/2019 7:55	0	0	0	0	36.6	0.936
MKS3__0028.LAB	4/23/2019 7:57	0	0	0	0	36.6	0.936
MKS3__0029.LAB	4/23/2019 8:07	0	0	19.7	0	36.5	0.937
MKS3__0030.LAB	4/23/2019 8:07	0	0	19.7	0	36.5	0.937
MKS3__0031.LAB	4/23/2019 8:08	0	0	19.6	0	36.6	0.936

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0032.LAB	4/23/2019 8:08	0	0	19.7	0	36.5	0.936
MKS3__0033.LAB	4/23/2019 8:08	0	0	19.7	0	36.5	0.936
MKS3__0034.LAB	4/23/2019 8:08	0	0	19.8	0	36.5	0.936
MKS3__0035.LAB	4/23/2019 8:09	0	0	19.8	0	36.5	0.936
MKS3__0036.LAB	4/23/2019 8:09	0	0	19.8	0	36.5	0.936
MKS3__0037.LAB	4/23/2019 8:09	0	0	19.8	0	36.5	0.936
MKS3__0038.LAB	4/23/2019 8:09	0	0	19.8	0	36.5	0.936
MKS3__0039.LAB	4/23/2019 8:10	0	0	19.8	0	36.5	0.936
MKS3__0040.LAB	4/23/2019 8:10	0	0	19.7	0	36.5	0.936
MKS3__0041.LAB	4/23/2019 8:13	98.2	0	0	0	36.4	0.936
MKS3__0042.LAB	4/23/2019 8:13	98.6	0	0	0	36.3	0.936
MKS3__0043.LAB	4/23/2019 8:13	99.1	0	0	0	36.3	0.936
MKS3__0044.LAB	4/23/2019 8:13	99.2	0	0	0	36.3	0.936
MKS3__0045.LAB	4/23/2019 8:14	99.3	0	0	0	36.4	0.936
MKS3__0046.LAB	4/23/2019 8:14	99.6	0	0	0	36.4	0.936
MKS3__0047.LAB	4/23/2019 8:14	99.7	0	0	0	36.4	0.936
MKS3__0048.LAB	4/23/2019 8:14	99.8	0	0	0	36.4	0.936
MKS3__0049.LAB	4/23/2019 8:15	100	0	0	0	36.5	0.936
MKS3__0050.LAB	4/23/2019 8:35	0	0.0554	0	0.897	36.6	0.935
MKS3__0051.LAB	4/23/2019 8:37	0	0.0557	0	0.897	36.6	0.935
MKS3__0052.LAB	4/23/2019 8:39	0	0.0553	0	0.903	36.6	0.935
MKS3__0053.LAB	4/23/2019 8:41	0	0.0560	0	0.914	36.6	0.935
MKS3__0054.LAB	4/23/2019 8:48	0	0.0543	0	0.921	36.5	0.936
MKS3__0055.LAB	4/23/2019 8:50	0	0.0554	0	0.916	36.5	0.936
MKS3__0056.LAB	4/23/2019 8:52	0	0.0551	0	0.914	36.5	0.936
MKS3__0057.LAB	4/23/2019 8:54	0	0.0559	0	0.916	36.5	0.936
MKS3__0058.LAB	4/23/2019 8:57	0	0.0555	0	0.910	36.6	0.936
MKS3__0059.LAB	4/23/2019 8:59	0	0.0563	0	0.896	36.5	0.936
MKS3__0060.LAB	4/23/2019 9:01	0	0.0562	0	0.885	36.5	0.936
MKS3__0061.LAB	4/23/2019 9:03	0	0.0551	0	0.885	36.6	0.936
MKS3__0062.LAB	4/23/2019 9:05	0	0.0580	0	0.892	36.6	0.936

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0063.LAB	4/23/2019 9:07	0	0.0586	0	0.898	36.6	0.936
MKS3__0064.LAB	4/23/2019 9:09	0	0.0577	0	0.894	36.6	0.936
MKS3__0065.LAB	4/23/2019 9:11	0	0.0581	0	0.894	36.6	0.936
MKS3__0066.LAB	4/23/2019 9:13	0	0.0584	0	0.888	36.6	0.932
MKS3__0067.LAB	4/23/2019 9:15	0	0.0585	0	0.887	36.5	0.933
MKS3__0068.LAB	4/23/2019 9:17	0	0.0587	0	0.889	36.6	0.932
MKS3__0069.LAB	4/23/2019 9:20	0	0.0585	0	0.891	36.6	0.932
MKS3__0070.LAB	4/23/2019 9:22	0	0.0591	0	0.896	36.5	0.931
MKS3__0071.LAB	4/23/2019 9:24	0	0.0586	0	0.896	36.5	0.932
MKS3__0072.LAB	4/23/2019 9:26	0	0.0583	0	0.899	36.7	0.932
MKS3__0073.LAB	4/23/2019 9:28	0	0.0590	0	0.890	36.7	0.931
MKS3__0074.LAB	4/23/2019 9:30	0	0.0604	0	0.901	36.6	0.932
MKS3__0075.LAB	4/23/2019 9:32	1.75	0.0635	0	1.70	36.6	0.931
MKS3__0076.LAB	4/23/2019 9:34	0	0.0602	0	2.13	36.6	0.931
MKS3__0077.LAB	4/23/2019 9:36	0	0.0568	0	1.95	36.6	0.931
MKS3__0078.LAB	4/23/2019 9:38	0	0.0578	0	1.68	36.5	0.932
MKS3__0079.LAB	4/23/2019 9:40	0	0.0580	0	1.52	36.6	0.932
MKS3__0080.LAB	4/23/2019 9:43	0	0.0560	0	1.35	36.6	0.932
MKS3__0081.LAB	4/23/2019 9:45	0	0.0543	0	1.24	36.6	0.933
MKS3__0082.LAB	4/23/2019 9:47	0	0.0551	0	1.19	36.6	0.933
MKS3__0083.LAB	4/23/2019 9:49	0	0.0563	0	1.14	36.6	0.933
MKS3__0084.LAB	4/23/2019 9:51	0	0.0548	0	1.09	36.6	0.932
MKS3__0085.LAB	4/23/2019 9:53	0	0.0549	0	1.03	36.6	0.932
MKS3__0086.LAB	4/23/2019 9:55	0	0.0588	0	0.962	36.6	0.932
MKS3__0087.LAB	4/23/2019 9:57	0	0.0590	0	0.907	36.5	0.932
MKS3__0088.LAB	4/23/2019 9:59	0	0.0589	0	0.859	36.6	0.933
MKS3__0089.LAB	4/23/2019 10:01	0	0.0588	0	0.814	36.6	0.933
MKS3__0090.LAB	4/23/2019 10:03	0	0.0594	0	0.777	36.5	0.933
MKS3__0091.LAB	4/23/2019 10:06	0	0.0588	0	0.746	36.4	0.933
MKS3__0092.LAB	4/23/2019 10:08	0	0.0585	0	0.720	36.5	0.932
MKS3__0093.LAB	4/23/2019 10:10	0	0.0581	0	0.708	36.5	0.932

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0094.LAB	4/23/2019 10:12	0	0.0580	0	0.711	36.5	0.932
MKS3__0095.LAB	4/23/2019 10:14	0	0.0586	0	0.721	36.5	0.933
MKS3__0096.LAB	4/23/2019 10:16	0	0.0592	0	0.728	36.5	0.932
MKS3__0097.LAB	4/23/2019 10:18	0	0.0587	0	0.725	36.5	0.933
MKS3__0098.LAB	4/23/2019 10:20	0	0.0581	0	0.722	36.5	0.933
MKS3__0099.LAB	4/23/2019 10:22	0	0.0592	0	0.728	36.5	0.932
MKS3__0100.LAB	4/23/2019 10:24	0	0.0587	0	0.746	36.5	0.932
MKS3__0101.LAB	4/23/2019 10:27	0	0.0585	0	0.764	36.4	0.932
MKS3__0102.LAB	4/23/2019 10:29	0	0.0584	0	0.780	36.5	0.932
MKS3__0103.LAB	4/23/2019 10:31	0	0.0584	0	0.786	36.6	0.932
MKS3__0104.LAB	4/23/2019 10:33	0	0.0585	0	0.791	36.7	0.932
MKS3__0105.LAB	4/23/2019 10:35	0	0.0580	0	0.791	36.6	0.932
MKS3__0106.LAB	4/23/2019 10:37	0	0.0581	0	0.796	36.6	0.931
MKS3__0107.LAB	4/23/2019 10:39	0	0.0586	0	0.810	36.6	0.932
MKS3__0108.LAB	4/23/2019 10:41	0	0.0583	0	0.824	36.6	0.932
MKS3__0109.LAB	4/23/2019 10:43	0	0.0585	0	0.840	36.6	0.931
MKS3__0110.LAB	4/23/2019 10:45	0	0.0590	0	0.844	36.4	0.931
MKS3__0111.LAB	4/23/2019 10:47	0	0.0582	0	0.845	36.4	0.932
MKS3__0112.LAB	4/23/2019 10:50	0	0.0587	0	0.842	36.4	0.932
MKS3__0113.LAB	4/23/2019 10:52	0	0.0585	0	0.848	36.4	0.931
MKS3__0114.LAB	4/23/2019 10:54	0	0.0579	0	0.861	36.4	0.932
MKS3__0115.LAB	4/23/2019 10:56	0	0.0585	0	0.865	36.4	0.932
MKS3__0116.LAB	4/23/2019 10:58	0	0.0584	0	0.863	36.4	0.932
MKS3__0117.LAB	4/23/2019 11:00	0	0.0585	0	0.865	36.4	0.932
MKS3__0118.LAB	4/23/2019 11:02	0	0.0592	0	0.863	36.4	0.932
MKS3__0119BKG.LAB	4/23/2019 11:12	0	0	0	0	36.6	0.932
MKS3__0120.LAB	4/23/2019 11:15	0	0	19.7	0	36.6	0.932
MKS3__0121.LAB	4/23/2019 11:15	0	0	19.7	0	36.6	0.931
MKS3__0122.LAB	4/23/2019 11:15	0	0	19.7	0	36.6	0.931
MKS3__0123.LAB	4/23/2019 11:15	0	0	19.5	0	36.5	0.931
MKS3__0124.LAB	4/23/2019 11:16	0	0	19.6	0	36.6	0.931

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0125.LAB	4/23/2019 11:16	0	0	19.7	0	36.5	0.931
MKS3__0126.LAB	4/23/2019 11:20	0	0.0597	0	0.894	36.5	0.931
MKS3__0127.LAB	4/23/2019 11:22	0	0.0598	0	0.896	36.5	0.931
MKS3__0128.LAB	4/23/2019 11:24	0	0.0603	0	0.894	36.5	0.931
MKS3__0129.LAB	4/23/2019 11:26	0	0.0588	0	0.885	36.5	0.931
MKS3__0130.LAB	4/23/2019 11:28	0	0.0584	0	0.871	36.5	0.931
MKS3__0131.LAB	4/23/2019 11:30	0	0.0593	0	0.867	36.4	0.931
MKS3__0132.LAB	4/23/2019 11:33	0	0.0594	0	0.868	36.6	0.931
MKS3__0133.LAB	4/23/2019 11:35	0	0.0596	0	0.870	36.6	0.930
MKS3__0134.LAB	4/23/2019 11:37	0	0.0594	0	0.868	36.5	0.930
MKS3__0135.LAB	4/23/2019 11:39	0	0.0599	0	0.872	36.4	0.930
MKS3__0136.LAB	4/23/2019 11:41	0	0.0594	0	0.861	36.3	0.930
MKS3__0137.LAB	4/23/2019 11:43	0	0.0586	0	0.861	36.4	0.930
MKS3__0138.LAB	4/23/2019 11:45	0	0.0601	0	0.870	36.4	0.930
MKS3__0139.LAB	4/23/2019 11:47	0	0.0606	0	0.891	36.4	0.930
MKS3__0140.LAB	4/23/2019 11:49	1.30	0.0637	0	1.19	36.4	0.930
MKS3__0141.LAB	4/23/2019 11:51	0.944	0.0634	0	2.34	36.4	0.930
MKS3__0142.LAB	4/23/2019 11:53	0	0.0593	0	2.08	36.4	0.930
MKS3__0143.LAB	4/23/2019 11:56	0	0.0583	0	1.71	36.4	0.930
MKS3__0144.LAB	4/23/2019 11:58	0	0.0590	0	1.49	36.4	0.930
MKS3__0145.LAB	4/23/2019 12:00	0	0.0590	0	1.36	36.5	0.930
MKS3__0146.LAB	4/23/2019 12:02	0	0.0594	0	1.27	36.5	0.930
MKS3__0147.LAB	4/23/2019 12:04	0	0.0577	0	1.22	36.6	0.930
MKS3__0148.LAB	4/23/2019 12:06	0	0.0569	0	1.15	36.6	0.930
MKS3__0149.LAB	4/23/2019 12:08	0	0.0592	0	1.09	36.5	0.930
MKS3__0150.LAB	4/23/2019 12:10	0	0.0592	0	1.05	36.5	0.930
MKS3__0151.LAB	4/23/2019 12:12	0	0.0593	0	0.996	36.5	0.930
MKS3__0152.LAB	4/23/2019 12:14	0	0.0597	0	0.941	36.4	0.930
MKS3__0153.LAB	4/23/2019 12:16	0	0.0594	0	0.883	36.4	0.930
MKS3__0154.LAB	4/23/2019 12:19	0	0.0596	0	0.823	36.4	0.930
MKS3__0155.LAB	4/23/2019 12:21	0	0.0594	0	0.773	36.3	0.930

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0156.LAB	4/23/2019 12:23	0	0.0595	0	0.738	36.4	0.930
MKS3__0157.LAB	4/23/2019 12:25	0	0.0588	0	0.723	36.4	0.929
MKS3__0158.LAB	4/23/2019 12:27	0	0.0587	0	0.721	36.4	0.929
MKS3__0159.LAB	4/23/2019 12:29	0	0.0583	0	0.724	36.4	0.929
MKS3__0160.LAB	4/23/2019 12:31	0	0.0581	0	0.722	36.4	0.929
MKS3__0161.LAB	4/23/2019 12:33	0	0.0587	0	0.717	36.3	0.929
MKS3__0162.LAB	4/23/2019 12:35	0	0.0581	0	0.713	36.4	0.929
MKS3__0163.LAB	4/23/2019 12:37	0	0.0585	0	0.717	36.4	0.929
MKS3__0164.LAB	4/23/2019 12:40	0	0.0584	0	0.732	36.4	0.929
MKS3__0165.LAB	4/23/2019 12:42	0	0.0591	0	0.742	36.4	0.929
MKS3__0166.LAB	4/23/2019 12:44	0	0.0585	0	0.749	36.4	0.929
MKS3__0167.LAB	4/23/2019 12:46	0	0.0587	0	0.758	36.2	0.929
MKS3__0168.LAB	4/23/2019 12:48	0	0.0590	0	0.764	36.3	0.928
MKS3__0169.LAB	4/23/2019 12:50	0	0.0593	0	0.768	36.4	0.927
MKS3__0170.LAB	4/23/2019 12:52	0	0.0590	0	0.781	36.3	0.928
MKS3__0171.LAB	4/23/2019 12:54	0	0.0588	0	0.789	36.4	0.927
MKS3__0172.LAB	4/23/2019 12:56	0	0.0587	0	0.788	36.4	0.927
MKS3__0173.LAB	4/23/2019 12:58	0	0.0590	0	0.789	36.5	0.927
MKS3__0174.LAB	4/23/2019 13:00	0	0.0589	0	0.789	36.4	0.927
MKS3__0175.LAB	4/23/2019 13:03	0	0.0595	0	0.792	36.5	0.927
MKS3__0176.LAB	4/23/2019 13:05	0	0.0591	0	0.794	36.4	0.927
MKS3__0177.LAB	4/23/2019 13:07	0	0.0598	0	0.797	36.4	0.927
MKS3__0178.LAB	4/23/2019 13:09	0	0.0588	0	0.788	36.4	0.927
MKS3__0179.LAB	4/23/2019 13:11	0	0.0589	0	0.785	36.4	0.927
MKS3__0180.LAB	4/23/2019 13:13	0	0.0591	0	0.791	36.4	0.927
MKS3__0181.LAB	4/23/2019 13:15	0	0.0589	0	0.792	36.3	0.927
MKS3__0182.LAB	4/23/2019 13:17	0	0.0595	0	0.794	36.4	0.927
MKS3__0183.LAB	4/23/2019 13:19	0	0.0586	0	0.815	36.3	0.927
MKS3__0184.LAB	4/23/2019 13:21	0	0.0583	0	0.816	36.3	0.927
MKS3__0185BKG.LAB	4/23/2019 13:29	0	0	0	0	36.4	0.927
MKS3__0186.LAB	4/23/2019 13:30	0	0	0	0	36.3	0.927

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0187.LAB	4/23/2019 13:30	0	0	0	0	36.4	0.927
MKS3__0188.LAB	4/23/2019 13:30	0	0	0	0	36.4	0.927
MKS3__0189.LAB	4/23/2019 13:31	0	0	0	0	36.4	0.927
MKS3__0190.LAB	4/23/2019 13:33	0	0	19.7	0	36.4	0.927
MKS3__0191.LAB	4/23/2019 13:33	0	0	19.7	0	36.4	0.927
MKS3__0192.LAB	4/23/2019 13:33	0	0	19.7	0	36.4	0.927
MKS3__0193.LAB	4/23/2019 13:33	0	0	19.8	0	36.3	0.927
MKS3__0194.LAB	4/23/2019 13:34	0	0	19.8	0	36.3	0.927
MKS3__0195.LAB	4/23/2019 13:34	0	0	19.7	0	36.3	0.927
MKS3__0196.LAB	4/23/2019 13:38	0	0.0603	0	0.816	36.3	0.927
MKS3__0197.LAB	4/23/2019 13:40	0	0.0602	0	0.815	36.3	0.927
MKS3__0198.LAB	4/23/2019 13:43	0	0.0598	0	0.803	36.4	0.927
MKS3__0199.LAB	4/23/2019 13:45	0	0.0599	0	0.807	36.4	0.927
MKS3__0200.LAB	4/23/2019 13:47	0	0.0598	0	0.818	36.2	0.927
MKS3__0201.LAB	4/23/2019 13:49	0	0.0601	0	0.827	36.2	0.927
MKS3__0202.LAB	4/23/2019 13:51	0	0.0607	0	0.825	36.3	0.927
MKS3__0203.LAB	4/23/2019 13:53	0	0.0589	0	0.808	36.3	0.927
MKS3__0204.LAB	4/23/2019 13:55	0	0.0590	0	0.803	36.3	0.927
MKS3__0205.LAB	4/23/2019 13:57	0	0.0587	0	0.805	36.3	0.927
MKS3__0206.LAB	4/23/2019 13:59	0	0.0594	0	0.810	36.2	0.927
MKS3__0207.LAB	4/23/2019 14:01	0	0.0591	0	0.817	36.2	0.927
MKS3__0208.LAB	4/23/2019 14:03	0	0.0590	0	0.812	36.2	0.927
MKS3__0209.LAB	4/23/2019 14:06	0	0.0596	0	0.804	36.3	0.926
MKS3__0210.LAB	4/23/2019 14:08	0	0.0605	0	0.800	36.3	0.926
MKS3__0211.LAB	4/23/2019 14:10	0	0.0604	0	0.802	36.3	0.926
MKS3__0212.LAB	4/23/2019 14:12	0	0.0600	0	0.802	36.3	0.926
MKS3__0213.LAB	4/23/2019 14:14	0	0.0595	0	0.800	36.3	0.926
MKS3__0214.LAB	4/23/2019 14:16	0	0.0604	0	0.805	36.3	0.926
MKS3__0215.LAB	4/23/2019 14:18	1.00	0.0634	0	1.06	36.1	0.926
MKS3__0216.LAB	4/23/2019 14:20	1.06	0.0634	0	2.32	36.3	0.926
MKS3__0217.LAB	4/23/2019 14:22	0	0.0592	0	1.95	36.4	0.926

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0218.LAB	4/23/2019 14:24	0	0.0598	0	1.63	36.4	0.926
MKS3__0219.LAB	4/23/2019 14:26	0	0.0588	0	1.43	36.4	0.926
MKS3__0220.LAB	4/23/2019 14:29	0	0.0571	0	1.28	36.3	0.926
MKS3__0221.LAB	4/23/2019 14:31	0	0.0550	0	1.21	36.2	0.926
MKS3__0222.LAB	4/23/2019 14:33	0	0.0588	0	1.16	36.2	0.926
MKS3__0223.LAB	4/23/2019 14:35	0	0.0553	0	1.07	36.3	0.926
MKS3__0224.LAB	4/23/2019 14:37	0	0.0599	0	1.04	36.2	0.926
MKS3__0225.LAB	4/23/2019 14:39	0	0.0593	0	0.978	36.1	0.926
MKS3__0226.LAB	4/23/2019 14:41	0	0.0605	0	0.925	36.2	0.926
MKS3__0227.LAB	4/23/2019 14:43	0	0.0599	0	0.865	36.2	0.926
MKS3__0228.LAB	4/23/2019 14:45	0	0.0599	0	0.796	36.2	0.926
MKS3__0229.LAB	4/23/2019 14:47	0	0.0596	0	0.740	36.4	0.926
MKS3__0230.LAB	4/23/2019 14:49	0	0.0595	0	0.700	36.3	0.926
MKS3__0231.LAB	4/23/2019 14:52	0	0.0592	0	0.675	36.2	0.926
MKS3__0232.LAB	4/23/2019 14:54	0	0.0587	0	0.656	36.2	0.926
MKS3__0233.LAB	4/23/2019 14:56	0	0.0588	0	0.640	36.3	0.926
MKS3__0234.LAB	4/23/2019 14:58	0	0.0585	0	0.638	36.2	0.926
MKS3__0235.LAB	4/23/2019 15:00	0	0.0588	0	0.642	36.1	0.926
MKS3__0236.LAB	4/23/2019 15:02	0	0.0584	0	0.648	36.2	0.926
MKS3__0237.LAB	4/23/2019 15:04	0	0.0587	0	0.648	36.2	0.926
MKS3__0238.LAB	4/23/2019 15:06	0	0.0581	0	0.651	36.6	0.926
MKS3__0239.LAB	4/23/2019 15:08	0	0.0584	0	0.654	36.8	0.926
MKS3__0240.LAB	4/23/2019 15:10	0	0.0580	0	0.669	36.7	0.926
MKS3__0241.LAB	4/23/2019 15:13	0	0.0583	0	0.676	36.6	0.926
MKS3__0242.LAB	4/23/2019 15:15	0	0.0587	0	0.685	36.5	0.926
MKS3__0243.LAB	4/23/2019 15:17	0	0.0585	0	0.696	36.4	0.926
MKS3__0244.LAB	4/23/2019 15:19	0	0.0586	0	0.699	36.5	0.926
MKS3__0245.LAB	4/23/2019 15:21	0	0.0583	0	0.696	36.5	0.926
MKS3__0246.LAB	4/23/2019 15:23	0	0.0585	0	0.692	36.6	0.926
MKS3__0247.LAB	4/23/2019 15:25	0	0.0589	0	0.692	36.7	0.926
MKS3__0248.LAB	4/23/2019 15:27	0	0.0588	0	0.697	36.5	0.926

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0249.LAB	4/23/2019 15:29	0	0.0584	0	0.708	36.4	0.927
MKS3__0250.LAB	4/23/2019 15:31	0	0.0581	0	0.710	36.6	0.927
MKS3__0251.LAB	4/23/2019 15:33	0	0.0587	0	0.703	36.5	0.926
MKS3__0252.LAB	4/23/2019 15:40	7.40	0.0488	0	0.664	36.6	0.914
MKS3__0253.LAB	4/23/2019 15:40	7.43	0.0483	0	0.663	36.6	0.913
MKS3__0254.LAB	4/23/2019 15:40	7.27	0.0450	0	0.665	36.5	0.914
MKS3__0255.LAB	4/23/2019 15:40	7.37	0.0472	0	0.664	36.5	0.913
MKS3__0256.LAB	4/23/2019 15:41	7.29	0.0469	0	0.663	36.5	0.913
MKS3__0257.LAB	4/23/2019 15:41	7.37	0.0465	0	0.665	36.5	0.913
MKS3__0258.LAB	4/23/2019 15:41	7.48	0.0468	0	0.665	36.6	0.913
MKS3__0259.LAB	4/23/2019 15:41	7.55	0.0465	0	0.665	36.5	0.913
MKS3__0260.LAB	4/23/2019 15:42	7.58	0.0479	0	0.662	36.6	0.914
MKS3__0261.LAB	4/23/2019 15:42	7.62	0.0457	0	0.665	36.6	0.914
MKS3__0262.LAB	4/23/2019 15:42	7.62	0.0488	0	0.663	36.5	0.914
MKS3__0263.LAB	4/23/2019 15:42	7.67	0.0472	0	0.663	36.5	0.913
MKS3__0264.LAB	4/23/2019 15:43	7.66	0.0481	0	0.662	36.6	0.913
MKS3__0265.LAB	4/23/2019 15:43	7.65	0.0486	0	0.660	36.5	0.913
MKS3__0266.LAB	4/23/2019 15:43	7.69	0.0462	0	0.660	36.4	0.913
MKS3__0267.LAB	4/23/2019 15:43	7.80	0.0459	0	0.662	36.4	0.914
MKS3__0268.LAB	4/23/2019 15:44	7.66	0.0476	0	0.665	36.3	0.913
MKS3__0269.LAB	4/23/2019 15:44	7.77	0.0490	0	0.664	36.3	0.913
MKS3__0270.LAB	4/23/2019 15:44	7.67	0.0473	0	0.667	36.3	0.913
MKS3__0271.LAB	4/23/2019 15:45	7.73	0.0471	0	0.669	36.3	0.914
MKS3__0272.LAB	4/23/2019 15:45	7.79	0.0473	0	0.669	36.2	0.913
MKS3__0273.LAB	4/23/2019 15:45	7.72	0.0470	0	0.668	36.2	0.913
MKS3__0274.LAB	4/23/2019 15:45	7.74	0.0479	0	0.668	36.2	0.913
MKS3__0275.LAB	4/23/2019 15:46	7.76	0.0471	0	0.671	36.2	0.913
MKS3__0276.LAB	4/23/2019 15:46	7.62	0.0469	0	0.672	36.2	0.913
MKS3__0277.LAB	4/23/2019 15:46	7.61	0.0489	0	0.670	36.2	0.913
MKS3__0278.LAB	4/23/2019 15:46	7.59	0.0491	0	0.666	36.3	0.913
MKS3__0279.LAB	4/23/2019 15:47	7.79	0.0479	0	0.666	36.3	0.913

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0280.LAB	4/23/2019 15:47	7.90	0.0476	0	0.669	36.3	0.913
MKS3__0281.LAB	4/23/2019 15:52	0	0	0	0	36.2	0.913
MKS3__0282.LAB	4/23/2019 15:53	0	0	0	0	36.2	0.913
MKS3__0283.LAB	4/23/2019 15:53	0	0	0	0	36.2	0.913
MKS3__0284.LAB	4/23/2019 15:53	0	0	0	0	36.3	0.914
MKS3__0285.LAB	4/23/2019 15:53	0	0	0	0	36.4	0.914
MKS3__0286.LAB	4/23/2019 15:54	0	0	0	0	36.5	0.913
MKS3__0287.LAB	4/23/2019 15:54	0	0	0	0	36.6	0.913
MKS3__0288.LAB	4/23/2019 15:54	0	0	0	0	36.6	0.913
MKS3__0289.LAB	4/23/2019 15:54	0	0	0	0	36.7	0.913
MKS3__0290.LAB	4/23/2019 15:55	0	0	0	0	36.7	0.913
MKS3__0291.LAB	4/23/2019 15:55	0	0	0	0	36.7	0.913
MKS3__0292.LAB	4/23/2019 15:55	0	0	0	0	36.8	0.913
MKS3__0293.LAB	4/23/2019 15:55	0	0	0	0	36.8	0.913
MKS3__0294BKG.LAB	4/23/2019 15:58	0	0	0	0	36.8	0.913
MKS3__0295.LAB	4/23/2019 16:00	1.45	0	19.7	0	36.5	0.913
MKS3__0296.LAB	4/23/2019 16:01	1.40	0	19.8	0	36.5	0.913
MKS3__0297.LAB	4/23/2019 16:01	1.54	0	19.7	0	36.4	0.913
MKS3__0298.LAB	4/23/2019 16:01	1.48	0	19.7	0	36.5	0.913
MKS3__0299.LAB	4/23/2019 16:01	1.46	0	19.6	0	36.4	0.914
MKS3__0300.LAB	4/23/2019 16:03	1.07	4.88	1.01	0	36.5	0.913
MKS3__0301.LAB	4/23/2019 16:03	1.11	4.89	0.984	0	36.5	0.914
MKS3__0302.LAB	4/23/2019 16:03	1.29	4.89	0.980	0	36.4	0.913
MKS3__0303.LAB	4/23/2019 16:03	1.21	4.89	1.15	0	36.4	0.913
MKS3__0304.LAB	4/23/2019 16:04	1.13	4.89	1.02	0	36.5	0.913
MKS3__0305.LAB	4/23/2019 16:04	1.18	4.89	1.05	0	36.5	0.913
MKS3__0306.LAB	4/23/2019 16:10	2.52	2.28	1.54	0.406	36.4	0.543
MKS3__0307.LAB	4/23/2019 16:10	2.49	2.28	1.49	0.410	36.5	0.543
MKS3__0308.LAB	4/23/2019 16:10	2.39	2.27	1.45	0.414	36.5	0.544
MKS3__0309.LAB	4/23/2019 16:10	2.40	2.26	1.45	0.418	36.5	0.544
MKS3__0310.LAB	4/23/2019 16:11	2.29	2.26	1.50	0.420	36.5	0.544

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0311.LAB	4/23/2019 16:11	2.48	2.25	1.55	0.424	36.5	0.545
MKS3__0312.LAB	4/23/2019 16:11	2.37	2.25	1.53	0.427	36.5	0.545
MKS3__0313.LAB	4/23/2019 16:12	2.41	2.25	1.59	0.429	36.5	0.545
MKS3__0314.LAB	4/23/2019 16:12	2.45	2.25	1.60	0.431	36.4	0.545
MKS3__0315.LAB	4/23/2019 16:12	2.36	2.24	1.57	0.434	36.4	0.546
MKS3__0316.LAB	4/23/2019 16:12	2.40	2.25	1.48	0.436	36.4	0.546
MKS3__0317.LAB	4/23/2019 16:13	2.54	2.24	1.62	0.438	36.4	0.547
MKS3__0318.LAB	4/23/2019 16:13	2.41	2.24	1.48	0.439	36.4	0.547
MKS3__0319.LAB	4/23/2019 16:13	2.32	2.24	1.47	0.441	36.4	0.547
MKS3__0320.LAB	4/23/2019 16:13	2.32	2.24	1.50	0.443	36.4	0.547
MKS3__0321.LAB	4/23/2019 16:14	2.36	2.24	1.47	0.445	36.4	0.548
MKS3__0322.LAB	4/23/2019 16:14	2.30	2.23	1.41	0.447	36.4	0.548
MKS3__0323.LAB	4/23/2019 16:14	2.43	2.23	1.47	0.449	36.4	0.548
MKS3__0324.LAB	4/23/2019 16:14	2.36	2.22	1.43	0.450	36.4	0.549
MKS3__0325.LAB	4/23/2019 16:15	2.33	2.22	1.54	0.452	36.3	0.549
MKS3__0326.LAB	4/23/2019 16:17	1.79	1.22	3.56	0.261	36.3	1.19
MKS3__0327.LAB	4/23/2019 16:17	1.86	1.22	3.60	0.259	36.3	1.19
MKS3__0328.LAB	4/23/2019 16:17	1.85	1.22	3.64	0.258	36.3	1.19
MKS3__0329.LAB	4/23/2019 16:18	1.81	1.22	3.64	0.257	36.3	1.19
MKS3__0330.LAB	4/23/2019 16:18	1.82	1.22	3.67	0.256	36.2	1.19
MKS3__0331.LAB	4/23/2019 16:18	1.81	1.22	3.60	0.256	36.2	1.19
MKS3__0332.LAB	4/23/2019 16:18	1.86	1.22	3.64	0.256	36.3	1.19
MKS3__0333.LAB	4/23/2019 16:19	1.87	1.22	3.64	0.255	36.3	1.19
MKS3__0334.LAB	4/23/2019 16:19	1.81	1.21	3.69	0.255	36.3	1.19
MKS3__0335.LAB	4/23/2019 16:19	1.82	1.21	3.60	0.255	36.4	1.19
MKS3__0336.LAB	4/23/2019 16:19	1.75	1.21	3.67	0.255	36.4	1.19
MKS3__0337.LAB	4/23/2019 16:20	1.81	1.21	3.69	0.255	36.4	1.19
MKS3__0338.LAB	4/23/2019 16:20	1.77	1.21	3.66	0.254	36.4	1.19
MKS3__0339.LAB	4/23/2019 16:20	1.89	1.21	3.68	0.254	36.4	1.19
MKS3__0340.LAB	4/23/2019 16:20	1.85	1.21	3.65	0.254	36.3	1.19
MKS3__0341.LAB	4/23/2019 16:21	1.77	1.21	3.64	0.254	36.3	1.19

File Name	Date/Time	Ethylene Oxide PPMv, Wet	Sulfur Hexa-fluoride PPMv, Wet	Ethylene PPMv, Wet	Water Vapor %v/v, Wet	Temp °C,	Pressure Atm.,
MKS3__0342.LAB	4/23/2019 16:21	1.84	1.21	3.66	0.254	36.3	1.19
MKS3__0343.LAB	4/23/2019 16:21	1.73	1.21	3.65	0.254	36.3	1.19
MKS3__0344.LAB	4/23/2019 16:21	1.77	1.21	3.66	0.254	36.3	1.19
MKS3__0345.LAB	4/23/2019 16:22	1.73	1.21	3.70	0.254	36.3	1.19
MKS3__0346.LAB	4/23/2019 16:22	1.74	1.21	3.62	0.255	36.4	1.19

Appendix B

FTIR Spectral Log Attestation
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

System Identification:	MKS - Instrument MKS3
Test Start Date:	April 23, 2019
Test End Date:	April 23, 2019

No. of Target Constituents:	4
No. of FTIR Log Entries:	346

First Log Entry:	MKS3__0001.LAB	4/23/2019 6:48
Last Log Entry:	MKS3__0346.LAB	4/23/2019 16:22

The preceding log of collected FTIR spectra, as identified above, is a true and accurate record of instrument results contingent to the standardized instrument software and operator configured method maps. Instrument baseline 'noise' recorded below the QLs have been normalized to zero. No other adjustment to the raw instrument/software generated results have been made. I certify the log is a true record of the test results subject to the precision and accuracy of the method, matrix and instrumentation.

Brett D. Erickson

Note: Quantitation limits (QLs) are applied to the average results for the finalized report tables in accordance with regulatory guidelines and project objectives.

Appendix C

Calculation Equations and Report Nomenclature

Calculation Equations

Flue Gas Linear Velocity:

$$V_s = 85.49 \times C_p \times \sqrt{\overline{\Delta P}} \times \sqrt{\frac{\overline{T_s}}{P_s \times M_s}}$$

$$1.064 = 85.49 \times 0.84 \times 0.01629 \times \sqrt{\frac{216 + 459.67}{28.40 \times 28.74}}$$

Volumetric Flow Rates - ACFM, SCFM, DSCFM:

$$Q = 60 \times v_s \times A$$

$$298 = 60 \times 1.064 \times 4.666$$

$$Q_s = Q \times \left(\frac{528}{T_s}\right) \times \left(\frac{P_s}{29.92}\right)$$

$$221 = 298 \times \frac{528}{675.7} \times \frac{28.40}{29.92}$$

$$Q_{sd} = Q_s \times (1 - B_{ws})$$

$$216 = 221 \times (1 - 0.024)$$

Mass Flow Rate Wet Flue Gas

$$m_g = \frac{4.995 \times Q_{sd} \times G_d}{1 - B_{ws}}$$

$$821 = \frac{4.995 \times 216 \times 0.7434}{(1 - 0.024)}$$

Actual Gas Density

$$\rho = \frac{0.04585 \times P_s \times M_s}{\overline{T_s}}$$

$$0.0554 = \frac{0.0459 \times 28.40 \times 28.74}{675.7}$$

Where:

A	=	Cross-sectional area of duct at sample point (sq. ft.).
B_{ws}	=	Water vapor in gas stream (proportion by volume).
C_p	=	Pitot tube calibration coefficient.
G_d	=	Flue gas specific gravity relative to air, dimensionless.
m_g	=	Mass flow rate of wet flue gas (LB/HR).
M_s	=	Molecular weight of wet flue gas (LB/LB-mole).
P_s	=	Absolute gas pressure of duct (Inches Hg).
ΔP	=	Velocity pressure measured by pitot tube (Inches WC).
Q	=	Actual flue gas volumetric flow rate (ACFM).
Q_s	=	Volumetric gas flow at standard conditions (SCFM).
Q_{sd}	=	Dry standard volumetric gas flow rate (DSCFM).
T_s	=	Flue gas temperature (°R).
V_s	=	Flue gas linear velocity (feet per second).
ρ	=	Actual flue gas density (LB/CF).

Appendix C - Calculation Equations

Psychrometric Moisture Calculations

Ethylene Oxide Abator Thermal Oxidizer Outlet

Test 1, Run 3

As reported on Table 6

Saturated Water Vapor Pressure:

VP_s = 1.932 Indexed from Vapor Pressure of Water Table for: T_{wb} = 100

Source Gas Water Vapor Pressure:

$$VP_a = VP_s - \left(0.000367 \times P_s \times (T_{db} - T_{wb}) \times \left(1 + \left(\frac{(T_{wb} - 32)}{1571}\right)\right)\right)$$

$$0.671 = 1.932 - \left| 0.000367 \times 28.40 \times (216 - 100) \times \left| 1 + \frac{(100 - 32)}{1571} \right| \right|$$

Psychrometric Moisture Content:

$$MC\% = \frac{VP_a}{P_s} \times 100 \qquad 2.36 = \frac{0.671}{28.40} \times 100$$

Where:

MC%	=	Moisture content of stack gas, %v/v.
P_s	=	Absolute pressure of stack gas, inches Hg.
T_{db}	=	Dry bulb temperature measurement, °F.
T_{wb}	=	Wet bulb temperature measurement, °F.
VP_a	=	Water vapor pressure of stack gas, inches Hg.
VP_s	=	Saturated water vapor pressure at wet bulb temp. and 29.92" Hg.

VAPOR PRESSURE OF WATER ("Hg)

	0	1	2	3	4	5	6	7	8	9
0	0.0376	0.0398	0.0417	0.0441	0.0463	0.0489	0.0517	0.0541	0.0571	0.0598
10	0.0631	0.066	0.0696	0.0728	0.0768	0.081	0.0846	0.0892	0.0932	0.0982
20	0.1025	0.108	0.1127	0.1186	0.1248	0.1302	0.137	0.1429	0.1502	0.1567
30	0.1647	0.1716	0.1803	0.1878	0.1955	0.2035	0.2118	0.2203	0.2292	0.2383
40	0.2478	0.2576	0.2677	0.2782	0.2891	0.3004	0.312	0.324	0.3364	0.3493
50	0.3626	0.3764	0.3906	0.4052	0.4203	0.4359	0.452	0.4686	0.4858	0.5035
60	0.5218	0.5407	0.5601	0.5802	0.6009	0.6222	0.6442	0.6669	0.6903	0.7144
70	0.7392	0.7648	0.7912	0.8183	0.8462	0.875	0.9046	0.9352	0.9666	0.9989
80	1.032	1.066	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.61	1.66	1.712	1.765	1.819	1.875
100	1.932	1.992	2.052	2.114	2.178	2.243	2.31	2.379	2.449	2.521
110	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
120	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.289	4.406
130	4.525	4.647	4.772	4.9	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.19	6.35	6.513	6.68	6.85	7.024	7.202	7.384
150	7.569	7.759	7.952	8.15	8.351	8.557	8.767	8.981	9.2	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.2	12.48	12.77	13.07	13.37	13.67	13.98	14.3	14.62	14.96
180	15.29	15.63	15.98	16.34	16.7	17.07	17.44	17.82	18.2	18.61
190	19.01	19.42	19.84	20.27	20.7	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26	26.53	27.07	27.62	28.18
210	28.75	29.33	29.92	30.52	31.13	31.75	32.38	33.02	33.67	34.33
220	35	35.68	36.37	37.07	37.78	38.5	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.14	49.03	49.93
240	50.84	51.76	52.7	53.65	54.62	55.6	56.6	57.61	58.63	59.67
250	60.72	61.79	62.88	63.98	65.1	66.23	67.38	68.54	69.72	70.92
260	72.13	74.36	74.61	75.88	77.16	78.46	79.78	81.11	82.46	83.83
270	85.22	86.63	88.06	89.51	90.97	92.45	93.96	95.49	97.03	98.61
280	100.2	101.8	103.4	105	106.7	108.4	110.1	111.8	113.6	115.4
290	117.2	119	120.8	122.7	124.6	126.5	128.4	130.4	132.4	134.4

Mass Analysis to Weight/Volume Concentration:

NA - Analyzed as gas

$$C_{mg/dscm} = \frac{m}{V_{std}}$$

NA = NA / NA (Ethylene Oxide)

Volume/Volume Concentration to Weight/Volume Concentration:

$$C_{mg/dscm} = C_{PPM-d} \times \frac{MW}{24.055}$$

1.39 = 0.757 x 44.05 / 24.055 (Ethylene Oxide)

µg/dscm	1,387	=	1.39	x	1000	Conversion Factor
GR/DSCF	0.000606	=	1.39	x	0.0004370	Conversion Factor
LB/DSCF	8.7E-08	=	1.39	x	6.24E-08	Conversion Factor

Weight/Volume Concentration to Volume/Volume Concentration:

$$C_{PPM-d} = C_{mg/dscm} \times \frac{24.055}{MW}$$

0.757 = 1.39 x 24.055 / 44.05 (Ethylene Oxide)

Constituent Emission Rate:

$$E_{Gas} = (6.243 \times 10^{-8}) \times 60 \times C_{mg/dscm} x DSCFM$$

0.000992 = 6.243E-08 x 60 x 1.39 x 191 (Ethylene Oxide)

Where:

$C_{mg/dscm}$	=	Constituent Concentration, mg/cubic meter.
C_{PPM-d}	=	Constituent Concentration, PPM v/v, dry basis.
DSCFM	=	Volumetric Airflow, dry standard cubic feet per minute.
E_{gas}	=	Constituent Emission Rate, LB/HR.
m	=	Mass of Constituent Collected, µg.
MW	=	Molecular Weight of Constituent.
V_{std}	=	Standard Volume of Air Sample, dry standard cubic meters.
24.055	=	Ideal gas molar volume at 293 °K and 760 mm Hg, liters/g-mole.
$6.243x10^{-8}$	=	Conversion From mg/dscm To LB/CF.
60	=	Conversion From Minutes to Hours.

Note: Calculations on this page are shown for dry basis concentrations.

Wet to Dry Concentration Correction:

$$C_{dry} = \frac{C_{wet}}{\left(1 - \frac{MC_{source}}{100}\right)}$$

$$0.757 = \frac{0.750}{\left(1 - \frac{0.95}{100}\right)}$$

(Ethylene Oxide)

Dry to Wet Concentration Correction:

$$C_{wet} = C_{dry} \times \left(1 - \frac{MC_{source}}{100}\right)$$

$$0.750 = 0.757 \times \left(1 - \frac{0.95}{100}\right)$$

(Ethylene Oxide)

Wet Analytical Basis to Wet Stack Basis

$$C_{wet-s} = \frac{C_{wet-a}}{\left(1 - \frac{MC_{analyses}}{100}\right)} \times \left(1 - \frac{MC_{source}}{100}\right)$$

Not applicable to this data set.

Where:

C_{dry}	=	Constituent Concentration, PPM v/v, dry basis.
C_{wet}	=	Constituent Concentration, PPM v/v, wet basis.
C_{wet-a}	=	Constituent Analyzed Concentration, PPM v/v, wet basis.
C_{wet-s}	=	Constituent Stack Concentration, PPM v/v, wet basis.
$MC_{analyses}$	=	Gas Moisture Content at Analyses, %v/v.
MC_{source}	=	Gas Moisture Content of Source Gas, %v/v.

Appendix C - Calculation Equations
Destruction/Reduction Efficiency
Ethylene Oxide Abator
Test 1 Run 1

Destruction Efficiency:

$$DRE = \frac{(MR_{Inlet} - MR_{Outlet})}{MR_{Inlet}} \times 100$$

$$99.7 = \frac{0.362 - \leq 0.00099}{0.362} \times 100 \quad \text{(Ethylene Oxide)}$$

Where:

DRE	=	Destruction, reduction or removal efficiency of a control device, %.
MR_{Inlet}	=	Mass Rate of a constituent or class of constituents routed to control device as measure at the inlet, LB/HR.
MR_{Outlet}	=	Mass Rate of same constituent or class of constituents exiting the control device as measured at the outlet, LB/HR.
100	=	Conversion to express as percent (%).

Report Nomenclature

Abbreviations, Symbols, and Nomenclature

“Hg	Inches of Mercury (pressure)
“WC	Inches Water Column (pressure)
°C	Degrees Centigrade or Celsius
°F	Degrees Fahrenheit
°K	Degrees Kelvin (absolute)
°R	Degrees Rankin (absolute)
% v/v	Percent by volume
% w/w	Percent by weight
ACFM	Actual Cubic Feet per Minute
AP-42	Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources.
BACT	Best Available Control Technology
BH	Baghouse
BHP	Brake Horsepower
BTU	British Thermal Unit
c	Centimeter
c^3	Cubic Centimeter
cc	Cubic Centimeter
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CE	Control Equipment (in Reg. ID Nos.)
CE	Control Efficiency
CEM	Continuous Emissions Monitor
CEMS	Continuous Emissions Monitoring System
CF	Cubic Feet
CFR	Code of Federal Regulations
C_1	Carbon (as carbon)
CH_4	Methane
C_3H_8	Propane
cm	Cubic Meter
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DGS	Distiller’s Grains with Solubles
DDGS	Dry Distiller’s Grains with Solubles
DRE	Destruction/Reduction Efficiency
DSCF	Dry Standard Cubic Feet
DSCFM	Dry Standard Cubic Feet per Minute
dscm	Dry Standard Cubic Meter
dscmm	Dry Standard Cubic Meter per Minute
dsl	Dry Standard Liter
EPA	Environmental Protection Agency
EP	Emission Point
ESP	Electrostatic Precipitator
EU	Emission Unit
FID	Flame Ionization Detector
FGR	Flue Gas Recirculation
FPD	Flame Photometric Detector
FPM	Feet Per Minute
FPS	Feet Per Second
FR	Federal Register
FT or ft	Foot or Feet
FT^3	Cubic Feet
FTIR	Fourier Transform Infrared
g	Gram
GC	Gas Chromatograph(y)
GPD	Gallons Per Day
GPH	Gallons Per Hour
GR	Grains
H_2O	Water
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HAPs	Hazardous Air Pollutants
Hg	Mercury
HP	Horsepower
HR	Hour
In.	Inch or Inches
KLB	Thousand Pounds
kW	Kilowatt
kWH	Kilowatt Hour
l	liter
LB	Pound or Pounds
LDAR	Leak Detection and Repair
m	Meter
m^3	Cubic Meter
MACT	Maximum Achievable Control Technology
MC	Moisture Content
µg	Microgram
µl	Microliter
µm	Micrometer (micron)
mg	Milligram
MGAL	Thousand Gallons
Min.	Minute or Minutes
ml	Milliliter
mm	Millimeter
MMBTU	Million British Thermal Units
MMSCF	Million Standard Cubic Feet
MS	Mass Spectrometry
MSDS	Material Safety Data Sheet
mW	Megawatt
MW	Molecular Weight
N_2	Nitrogen
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides (quantified as NO_2)
NSPS	New Source Performance Standard
O_2	Oxygen
PEMS	Parametric (or Predictive) Emissions Monitoring System
PID	Photo Ionization Detector
PM	Particulate Matter

PM_{10}	Particulate Matter with an aerodynamic diameter equal to or less than 10 microns
PM-10	PM_{10}
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter equal to or less than 2.5 microns
PM-2.5	$PM_{2.5}$
PPB	Parts Per Billion (see variation below)
PPM	Parts Per Million
PPMv	Part Per Million by volume
PPMv-dry	Parts Per Million by volume, dry basis
PPMv-wet	Parts Per Million by volume, wet basis
PPMw	Parts Per Million by Weight (mg/l)
PSIA	Pounds per Square Inch, Absolute
PSIG	Pounds per Square Inch, Gauge
PTE	Permanent Total Enclosure
RA	Relative Accuracy
RATA	Relative Accuracy Test Audit
rH	Relative Humidity
RTO	Regenerative Thermal Oxidizer or Recuperative Thermal Oxidizer
SCF	Standard Cubic Feet
SCFM	Standard Cubic Feet per Minute
scm	Standard Cubic Meter
scmm	Standard Cubic Meter per Minute
Scr.	Scrubber
SIC	Standard Industrial Classification
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
Sq. Ft.	Square Feet
TCD	Thermal Conductivity Detector
TO	Thermal Oxidizer
TPD	Tons Per Day
TPH	Tons Per Hour
TPY	Tons per year
TRS	Total Reduced Sulfur
TSP	Total Suspended Particulate Matter
TTE	Temporary Total Enclosure
USEPA	United States Environmental Protection Agency
VHAP	Volatile Hazardous Air Pollutant
VOC	Volatile Organic Compound
VOCs	Volatile Organic Compounds
WC	Water Column
WDGS	Wet Distiller's Grains with Solubles

State Environmental Agency Acronyms

ADEM	Alabama Department of Environmental Management
ADEC	Alaska Department of Environmental Conservation
ADEQ	Arizona Department of Environmental Quality
ADEQ	Arkansas Department of Environmental Quality
CARB	California Air Resources Board
CDPHE	Colorado Department of Public Health & Environment
CDEP	Connecticut Department of Environmental Protection
DNREC	Delaware Natural Resources & Environmental Control
FDEP	Florida Department of Environmental Protection
GEPD	Georgia Environmental Protection Division
IDEQ	Idaho Department of Environmental Quality
IEPA	Illinois Environmental Protection Agency
IDNR	Iowa Department of Natural Resources
KDHE	Kansas Department of Health & Environment
KDEP	Kentucky Department for Environmental Protection
LDEQ	Louisiana Department of Environmental Quality
MDEP	Maine Department of Environmental Protection
MDE	Maryland Department of the Environment
MDEP	Massachusetts Department of Environmental Protection
MDEQ	Michigan Department of Environmental Quality
MPCA	Minnesota Pollution Control Agency
MDEQ	Mississippi Department of Environmental Quality
MDNR	Missouri Department of Natural Resources
MDEQ	Montana Department of Environmental Quality
NDEQ	Nebraska Department of Environmental Quality
NDEP	Nevada Division of Environmental Protection
NHDES	New Hampshire Department of Environmental Services
NJDEP	New Jersey Department of Environmental Protection
NMED	New Mexico Environment Department
NYSDEC	New York State Department of Environmental Conservation
NCDENR	North Carolina Department of Environment & Natural Resources
NDDH	North Dakota Department of Health
OEPA	Ohio Environmental Protection Agency
ODEQ	Oklahoma Department of Environmental Quality
ODEQ	Oregon Department of Environmental Quality
PDEP	Pennsylvania Department of Environmental Protection
RIDEM	Rhode Island Department of Environmental Management
SCDHEC	South Carolina Department of Health & Environmental Control
SDDENR	South Dakota Department of Environment & Natural Resources
TDEC	Tennessee Department of Environment & Conservation
TCEQ	Texas Commission on Environmental Quality
UDEQ	Utah Department of Environmental Quality
VANR	Vermont Agency of Natural Resources
VDEQ	Virginia Department of Environmental Quality
WSDNR	Washington State Department of Natural Resources
WVDEP	West Virginia Division of Environmental Protection
WDNR	Wisconsin Department of Natural Resources

Appendix D

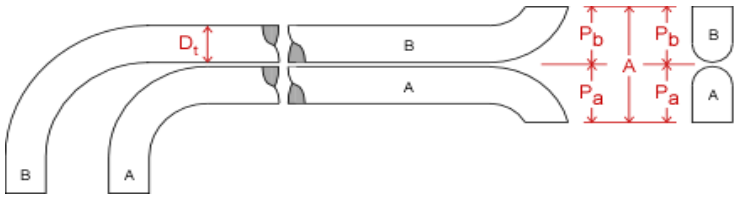
Quality Assurance Information

Sampling Train Calibration Data

Appendix D

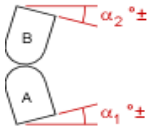
S-Type Pitot Verification Certificate
Pitot Tube No.: 3_15
Verification Date: 12/17/2018

S-Type Pitot Contruction and Mechanical Integrity Verification



Tube Obstruction Check	**Pass**		Tubing Diameter - D_t ($^3/_{16}$" to $^3/_8$")	**3/16"**	**Pass**
Check for Tip Damage	**Pass**		Distance Between Face Planes - A	**0.451"**	**Pass**
Face Planes Parallel	**Pass**		Base to Face Plane A Distance - P_a	**0.220"**	**Pass**
Part of an Assemby?	**No**		Base to Face Plane B Distance - P_b	**0.231"**	**Pass**
Nozzle Clearance	**NA**		Criterion:1.05Dt ≤ P ≤ 1.5Dt, P_a=P_b (± 2% of A)		
Thermocouple Clearance	**NA**				

Face Plane Alignment Verification



Longitudinal Deflection

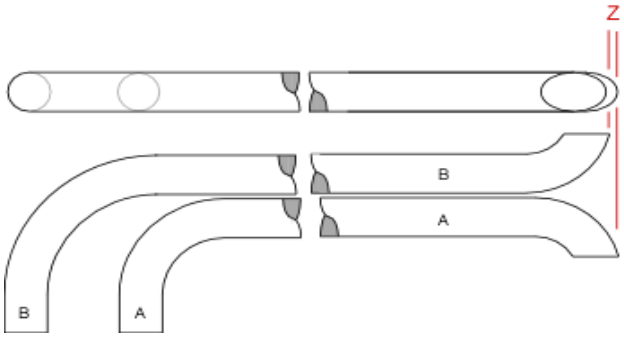
Plane A	**5°**	**Pass**
Plane B	**3°**	**Pass**

Criterion: ß1 and ß2 ≤ ±5°

Transverse Deflection

Plane A	**1°**	**Pass**
Plane B	**1°**	**Pass**

Criterion: α1 and α2 ≤ ±10°



Transverse Alignment - W **0.005"** **Pass**
Criterion: W ≤ 0.03125"

Longitudinal Alignment - Z **0.006"** **Pass**
Criterion: Z ≤ 0.125"

Verification performed pursuant to Pace Standard Operating Procedure: S-FSD-E-006

Verification specifications are: **Met**
Assigned baseline coefficient: **0.840**

Caliper ID **CL-4**
Protractor ID **AG-1**

Verified/Certified[1] By: J. Kokkinen 12/17/2018

[1] Certifying personnel identity validated by computer login and data entry tracking pursuant to Pace FSD SOP S-FSD-Q-004.

Appendix D

Atmospheric Barometer Certificate
Barometer No.: DB_59
Calibration Date: 9/12/2018

Make and Model:	iPhone 7	Pace SOP No.:	S-FSD-E-004	
Serial Number:	F17WCNBRHG6W	Reference Standard:	Princo-2	
Barometer Range:	11628 Inches Hg	Acceptance Criterion:	0.10	Inches Hg

Reference Barometric Pressure Inches Hg	As Found		As Left	
	Barometer Rdg Inches Hg	Difference Inches Hg	Barometer Rdg Inches Hg	Difference Inches Hg
29.09	29.16	0.07	29.16	0.07
	Acceptance Criterion	0.10		0.10
	Acceptance Status	**Pass**		**Pass**

Reference Barometric Pressure is determined from the raw mercury in glass absolute pressure reading of 29.21 and applying the appropriate temperature correction factor of -0.116 for 73°F at the time and place of calibration/verification.

Verified/Certified[1] By: T. Rehling 9/12/2018

[1] Certifying personnel identity validated by computer login and data entry tracking pursuant to SOP S-FSD-Q-004.

Make and Model:	Fluke 922	Pace SOP No.:	S-FSD-E-007
Serial Number:	28040372	Reference Standard:	Manometer #1 & #2
Pressure Range:	16.5 Inches of Water	Acceptance Criterion:	1.00% Of Scale

Reference Pressure In. H_2O	As Found EDM Rdg In. H_2O	As Found Difference % of Scale	As Left EDM Rdg In. H_2O	As Left Difference % of Scale
-14.90	-14.80	0.64%	-14.80	0.64%
-8.30	-8.25	0.32%	-8.25	0.32%
-0.80	-0.81	0.05%	-0.81	0.05%
0.00	0.00	0.01%	0.00	0.01%
0.80	0.80	0.02%	0.80	0.02%
8.30	8.22	0.47%	8.22	0.47%
14.90	14.80	0.62%	14.80	0.62%
	Average % Difference	0.30%	Average % Difference	0.30%
	Maximum % Difference	0.64%	Maximum % Difference	0.64%
	Acceptance Status	**Pass**	Acceptance Status	**Pass**
			Leak Check	**Pass**

Verified/Certified[1] By: L. Ruhland 2/25/2019

[1] Certifying personnel identity validated by computer login and data entry tracking pursuant to SOP S-FSD-Q-004.

Appendix D

Thermocouple Display Calibration Certificate
Thermocouple Display No.: TC_31
Calibration Date: 2/5/2019

Make and Model:	Omega HH12B	Pace SOP No.:	S-FSD-E-005
Serial Number:	111262	Reference Standard:	Omega CL23A
Temperature Range:	2000 Fahrenheit - °F	Acceptance Criterion:	1.50% °R (°F+460)

Reference Temperature °F	As Found Display Rdg °F	As Found Difference % of Rdg	As Left Display Rdg °F	As Left Difference % of Rdg
1800	1798	0.09%	1798	0.09%
1500	1498	0.10%	1498	0.10%
1000	999	0.07%	999	0.07%
500	500	0.00%	500	0.00%
200	200	0.05%	200	0.05%
100	100	0.02%	100	0.02%
0	0	0.09%	0	0.09%
	Average % Difference	0.06%	Average % Difference	0.06%
	Maximum % Difference	0.10%	Maximum % Difference	0.10%
	Acceptance Status	**Pass**	Acceptance Status	**Pass**
			Channel 2 Verification	**Pass**

Verified/Certified[1] By: L. Ruhland 2/5/2019

[1] Certifying personnel identity validated by computer login and data entry tracking pursuant to Pace FSD SOP S-FSD-Q-004.

Calibration Gas Certifications

PRAXAIR

Praxair Distribution Inc.
One Steel Road East
Morrisville, PA 19067
Tel: 1-800-638-6360
Fax: 1-215-736-5237

05/12/2016

PRAXAIR PKG ROSEVILLE MN P
2455 ROSEGATE
ROSEVILLE, MN 55113
Attention: PRAXAIR PKG ROSEVILLE MN P

Work Order No. **70065997**
Customer Reference No.

Product Lot/Batch No. **304313132601**
Product Part No. **NI SH1000P-AS**

CERTIFICATE OF ANALYSIS
Primary Standard

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Sulfur hexafluoride	**1000 ppm**	**1000 ppm**	**L**	**±1%**
Nitrogen	**balance**	**balance**		

Analytical Instruments: **MKS~FTIR~~**
Cylinder Style: **AS**
Cylinder Pressure @70F: **2000 psig**
Cylinder Volume: **142 ft3**
Valve Outlet Connection: **CGA-580**
Cylinder No(s). **CC99697**

Filling Method: **Gravimetric**
Date of Fill: **05/11/2016**
Expiration Date: **05/11/2021**

Analyst: **Jeff Gosner**

The gas calibration cylinder standard prepared by Praxair Distribution Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted.

Key to Analytical Techniques:

A	Flame Ionization with Methanizer	B	Gas Chromatography with Discharge Ionization Detector	C	Gas Chromatography with Electrolytic Conductivity Detector	D	Gas Chromatography with Flame Ionization Detector
E	Gas Chromatography with Flame Photometric Detector	F	Gas Chromatography with Helium Ionization Detector	G	Gas Chromatography with Methanizer Carbonizer	H	Gas Chromatography with Photoionization Detector
I	Gas Chromatography with Reduction Gas Analyzer	J	Gas Chromatography with Thermal Conductivity Detector	K	Binary Gas Analyzer with Thermal Conductivity Detector	L	Infrared - FTIR or NDIR
M	Mass Spectrometry - MS or GC/MS	N	By Difference of Typical Impurities	O	Paramagnetic	P	Specific Water Analyzer
Q	Total Hydrocarbon Analyzer	R	Wet Chemical	S	Detector Tube	T	Odor
U	Gravimetrical Methods	V	Electrochemical	W	Chemiluminescent	X	Vendor Analysis

IMPORTANT
The information contained herein has been prepared at your request by personnel within Praxair Distribution Inc.. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.

PRAXAIR
Making our planet more productive

Praxair Distribution, Inc.
6055 Brent Drive
Toledo, OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411

Customer & Order Information:

PRAXAIR PKG ROSEVILLE MN P
2455 ROSEGATE,
ROSEVILLE, MN 55113-2717

Praxair Order Number: **70813121**
Customer PO Number: **78795128**

Certificate Issuance Date: **12/20/2018**

Certification Date: **12/20/2018**
Lot Number: **700018351UF**
Part Number: **NI EY20MZC-AS**
DocNumber: **25570**
Expiration Date: **12/18/2023**

CERTIFICATE OF ANALYSIS

Certified Standard

Component	Requested Concentration (Molar)	Certified Concentration (Molar)	Analytical Reference	Analytical Uncertainty
Ethylene	**20.0 ppm**	**19.8 ppm**	**1**	**± 2%**
Nitrogen	**Balance**	**Balance**		

Cylinder Style: **AS**
Cylinder Pressure @ 70F: **2000 psig**
Cylinder Volume: **145 ft3**
Valve Outlet Connection: **CGA 350**
Cylinder Number(s): **EB0079337**

Fill Date: **12/17/2018**
Analysis Date: **12/18/2018**

Filling Method: **Gravimetric**

QA Reviewer: **Edward E Zucal**

Approved Signer: **Anthony Cekic**

Key to Analytical Techniques:

Reference	Analytical Instrument - Analytical Principle
1	MKS-2010 - FTIR

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted. Analytical uncertainty is expressed as a Relative % unless otherwise noted.

IMPORTANT
The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc.. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.

Praxair Distribution, Inc.
37256 Highway 30
Geismar, LA 70734
Tel : 225-677-7700
Fax : 225-673-3531

PRAXAIR PKG ROSEVILLE MN P
2455 ROSEGATE
ROSEVILLEMN55113

1/22/2018

Attention: PRAXAIR PKG ROSEVILLE MN P

Praxair Order No.: 70472336

Product Lot/Batch No.: 70340 8016 3J
Praxair Part No. : NI EO100C-AS

CERTIFICATE OF ANALYSIS
Certified Standard

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Ethylene oxide	100 ppm	100 ppm	D	+/-2 %
Nitrogen	balance	balance		

Analytical: Hewlett-Packard 6890
Cylinder Style: AS
Cylinder Pressure @70°F: 2000 psig
Cylinder Volume: 140 ft3
Valve Outlet Connection: CGA-350
Cylinder No(s).: EB0105491
Comments: Unit of Measure: Mole %

Filling Method: Gravimetric
Date of Fill: 1/16/2018
Expiration Date: 1/16/2020

Analyst

Eric Michel - Chemist

QA Reviewer

Lee Lehnus - Operations Supervisor

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted

Key to Analytical Techniques:
A Flame Ionization with Methanizer
B Gas Chromatography with Discharge Ionization Detector
C Gas Chromatography with Electrolytic Conductivity Detector
D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector
F Gas Chromatography with Helium Ionization Detector
G Gas Chromatography with Methanizer Carbonizer
H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer
J Gas Chromatography with Thermal Conductivity Detector
K Binary Gas Analyzer with Thermal Conductivity Detector
L IInfrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS
N By Difference of Typical Impurities
O Paramagnetic
P Specific Water Analyzer
Q Total Hydrocarbon Analyzer
R Wet Chemical
S Detector Tube
T Odor
U Gas Chromatography with Chemiluminescence Detector
V Electrochemical
W Electron Capture Detector
X Certified Gravimetrically
Y Chemiluminescence
Z N/A

IMPORTANT
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Praxair Distribution, Inc.
One Steel Rd East
Morrisville, PA 19067
Tel: 1-800-638-6360
Fax: 1-215-736-5237

05/12/2016

PRAXAIR PKG ROSEVILLE MN P
2455 ROSEGATE
ROSEVILLE, MN 55113
Attention: PRAXAIR PKG ROSEVILLE MN P

Work Order No. **70065997**
Customer Reference No.

Product Lot/Batch No. **304313132603**
Product Part No. **NI SH5MP-AS**

CERTIFICATE OF ANALYSIS
Primary Standard

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Sulfur hexafluoride	**5 ppm**	**4.95 ppm**	**L**	**±0.1ppm**
Nitrogen	**balance**	**balance**		

Analytical Instruments: **MKS~FTIR~~**
Cylinder Style: **AS**
Cylinder Pressure @70F: **2000 psig**
Cylinder Volume: **142 ft3**
Valve Outlet Connection: **CGA-580**
Cylinder No(s). **LCCO-SA11887**

Filling Method: **Gravimetric**
Date of Fill: **05/11/2016**
Expiration Date: **05/11/2021**

Analyst: **Jeff Gosner**

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted.

Key to Analytical Techniques:

A	Flame Ionization with Methanizer	B	Gas Chromatography with Discharge Ionization Detector	C	Gas Chromatography with Electrolytic Conductivity Detector	D	Gas Chromatography with Flame Ionization Detector
E	Gas Chromatography with Flame Photometric Detector	F	Gas Chromatography with Helium Ionization Detector	G	Gas Chromatography with Methanizer Carbonizer	H	Gas Chromatography with Photoionization Detector
I	Gas Chromatography with Reduction Gas Analyzer	J	Gas Chromatography with Thermal Conductivity Detector	K	Binary Gas Analyzer with Thermal Conductivity Detector	L	Infrared - FTIR or NDIR
M	Mass Spectrometry - MS or GC/MS	N	By Difference of Typical Impurities	O	Paramagnetic	P	Specific Water Analyzer
Q	Total Hydrocarbon Analyzer	R	Wet Chemical	S	Detector Tube	T	Odor
U	Gravimetrical Methods	V	Electrochemical	W	Chemiluminescent	X	Vendor Analysis

IMPORTANT
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FTIR Calibration Summary

Appendix D

FTIR Calibration Summary
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

FTIR Cell Path Length: 4.88m

Calibration Acceptance Criterion: ± 5.0%

Calibration Trial 1		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000038.LAB	4/23/19 8:09	19.91		
MKS2__000039.LAB	4/23/19 8:09	19.91		
MKS2__000040.LAB	4/23/19 8:10	19.87		
MKS2__000041.LAB	4/23/19 8:10	19.80		
MKS2__000042.LAB	4/23/19 8:10	**19.87**	**0.4%**	**Pass**

Calibration Trial 2		**Ethylene Oxide**	**Target PPMv: 100**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000069.LAB	4/23/19 8:19	97.67		
MKS2__000070.LAB	4/23/19 8:19	98.88		
MKS2__000071.LAB	4/23/19 8:19	98.23		
MKS2__000072.LAB	4/23/19 8:20	99.90		
MKS2__000073.LAB	4/23/19 8:20	**100.0**	**0.0%**	**Pass**

Calibration Trial 3		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000188.LAB	4/23/19 11:14	19.84		
MKS2__000189.LAB	4/23/19 11:15	19.91		
MKS2__000190.LAB	4/23/19 11:15	19.75		
MKS2__000191.LAB	4/23/19 11:15	19.97		
MKS2__000192.LAB	4/23/19 11:15	**19.94**	**0.7%**	**Pass**

Calibration Trial 4		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000258.LAB	4/23/19 13:32	19.94		
MKS2__000259.LAB	4/23/19 13:32	20.07		
MKS2__000260.LAB	4/23/19 13:32	20.03		
MKS2__000261.LAB	4/23/19 13:33	20.00		
MKS2__000262.LAB	4/23/19 13:33	**19.99**	**1.0%**	**Pass**

Calibration Deviation is based on the last of 5 stable cylinder gas readings.

Appendix D

FTIR Calibration Summary
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

FTIR Cell Path Length: 4.88m

Calibration Acceptance Criterion: ± 5.0%

Calibration Trial 5		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000334.LAB	4/23/19 16:00	19.74		
MKS2__000335.LAB	4/23/19 16:00	19.70		
MKS2__000336.LAB	4/23/19 16:00	19.59		
MKS2__000337.LAB	4/23/19 16:00	19.52		
MKS2__000338.LAB	4/23/19 16:01	**19.51**	**-1.4%**	**Pass**

Calibration Trial 6		**Sulfur Hexafluorid**	**Target PPMv: 4.95**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS2__000340.LAB	4/23/19 16:02	4.950		
MKS2__000341.LAB	4/23/19 16:02	4.954		
MKS2__000342.LAB	4/23/19 16:03	4.961		
MKS2__000343.LAB	4/23/19 16:03	4.955		
MKS2__000344.LAB	4/23/19 16:03	**4.942**	**-0.2%**	**Pass**

Calibration Deviation is based on the last of 5 stable cylinder gas readings.

Constituent	**Gas Concentration**	**Certificate No.**
Ethylene	19.8 PPMv	EB0079337
Ethylene Oxide	100 PPMv	EB0105491
Sulfur Hexafluoride	4.95 PPMv	SA11887

Appendix D

FTIR Calibration Summary
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

FTIR Cell Path Length: 5.11m Calibration Acceptance Criterion: ± 5.0%

Calibration Trial 1		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0036.LAB	4/23/19 8:09	19.77		
MKS3__0037.LAB	4/23/19 8:09	19.76		
MKS3__0038.LAB	4/23/19 8:09	19.78		
MKS3__0039.LAB	4/23/19 8:10	19.82		
MKS3__0040.LAB	4/23/19 8:10	**19.68**	**-0.6%**	**Pass**

Calibration Trial 2		**Ethylene Oxide**	**Target PPMv: 100**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0045.LAB	4/23/19 8:14	99.33		
MKS3__0046.LAB	4/23/19 8:14	99.63		
MKS3__0047.LAB	4/23/19 8:14	99.68		
MKS3__0048.LAB	4/23/19 8:14	99.83		
MKS3__0049.LAB	4/23/19 8:15	**100.0**	**0.0%**	**Pass**

Calibration Trial 3		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0121.LAB	4/23/19 11:15	19.74		
MKS3__0122.LAB	4/23/19 11:15	19.69		
MKS3__0123.LAB	4/23/19 11:15	19.52		
MKS3__0124.LAB	4/23/19 11:16	19.63		
MKS3__0125.LAB	4/23/19 11:16	**19.70**	**-0.5%**	**Pass**

Calibration Trial 4		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0191.LAB	4/23/19 13:33	19.68		
MKS3__0192.LAB	4/23/19 13:33	19.74		
MKS3__0193.LAB	4/23/19 13:33	19.77		
MKS3__0194.LAB	4/23/19 13:34	19.77		
MKS3__0195.LAB	4/23/19 13:34	**19.72**	**-0.4%**	**Pass**

Calibration Deviation is based on the last of 5 stable cylinder gas readings.

Appendix D

FTIR Calibration Summary
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

FTIR Cell Path Length: 5.11m

Calibration Acceptance Criterion: ± 5.0%

Calibration Trial 5		**Ethylene**	**Target PPMv: 19.8**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0295.LAB	4/23/19 16:00	19.67		
MKS3__0296.LAB	4/23/19 16:01	19.78		
MKS3__0297.LAB	4/23/19 16:01	19.74		
MKS3__0298.LAB	4/23/19 16:01	19.74		
MKS3__0299.LAB	4/23/19 16:01	**19.62**	**-0.9%**	**Pass**

Calibration Trial 6		**Sulfur Hexafluoride**	**Target PPMv: 4.95**	
Spectra File Name	Date and Time	PPMv	Deviation	Status
MKS3__0301.LAB	4/23/19 16:03	4.890		
MKS3__0302.LAB	4/23/19 16:03	4.890		
MKS3__0303.LAB	4/23/19 16:03	4.888		
MKS3__0304.LAB	4/23/19 16:04	4.889		
MKS3__0305.LAB	4/23/19 16:04	**4.890**	**-1.2%**	**Pass**

Calibration Deviation is based on the last of 5 stable cylinder gas readings.

Constituent	**Gas Concentration**	**Certificate No.**
Ethylene	19.8 PPMv	EB0079337
Ethylene Oxide	100 PPMv	EB0105491
Sulfur Hexafluoride (5)	4.95 PPMv	SA11887

FTIR Spike Summary

Appendix D

Flow Measured Matrix Spike Bias
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

	Pre Test	Post Test	Δ Flow %	% of Total Flow (avg)
Sample Gas Flow	3.30	3.33	0.9%	91.70%
Spike Gas Flow	0.30	0.30	0.0%	8.30%
Total Gas Flow	3.60	3.63	0.8%	
Spike % of Total Flow	8.3%	8.3%		
	≤10%	≤10%		

Method 320/301
Validation Protocol

Spike Constituent Ethylene Oxide
Cylinder Concentration 100 PPMv

Unspiked Average 0
Target Concentration 8.299

Unspiked Monitoring Results			Spiked Monitoring Results			Spike
Spectra File Name	Date and Time	FTIR, PPMv	Spectra File Name	Date and Time	FTIR, PPMv	Bias
MKS3__0240.LAB	4/23/19 15:10	0	MKS3__0257.LAB	4/23/19 15:41	7.371	88.8%
MKS3__0241.LAB	4/23/19 15:13	0	MKS3__0259.LAB	4/23/19 15:41	7.546	90.9%
MKS3__0242.LAB	4/23/19 15:15	0	MKS3__0261.LAB	4/23/19 15:42	7.621	91.8%
MKS3__0243.LAB	4/23/19 15:17	0	MKS3__0263.LAB	4/23/19 15:42	7.666	92.4%
MKS3__0244.LAB	4/23/19 15:19	0	MKS3__0265.LAB	4/23/19 15:43	7.652	92.2%
MKS3__0245.LAB	4/23/19 15:21	0	MKS3__0267.LAB	4/23/19 15:43	7.797	94.0%
MKS3__0246.LAB	4/23/19 15:23	0	MKS3__0269.LAB	4/23/19 15:44	7.771	93.6%
MKS3__0247.LAB	4/23/19 15:25	0	MKS3__0271.LAB	4/23/19 15:45	7.728	93.1%
MKS3__0248.LAB	4/23/19 15:27	0	MKS3__0273.LAB	4/23/19 15:45	7.725	93.1%
MKS3__0249.LAB	4/23/19 15:29	0	MKS3__0275.LAB	4/23/19 15:46	7.763	93.5%
MKS3__0250.LAB	4/23/19 15:31	0	MKS3__0277.LAB	4/23/19 15:46	7.606	91.6%
MKS3__0251.LAB	4/23/19 15:33	0	MKS3__0279.LAB	4/23/19 15:47	7.786	93.8%
	Average Concentration	**0**		Average Concentration	**7.669**	**92.4%**

$$\%Bias = \frac{C_{Mtrx+Spk}}{(\%F_{Matrix} \times C_{Matrix}) + (\%F_{Spike} \times C_{Spike})} \times 100$$

C_{Matrix} = Measured concentration of matrix gas.
C_{Spike} = Cylinder concentration of spike gas.
$C_{Mtrx+Spk}$ = Measured concentration of spiked matrix.
$\%F_{Matrix}$ = Percent of total flow for the matrix gas.
$\%F_{Spike}$ = Percent of total flow for the spike gas.

Acceptance Range 70%-130%

Acceptance Status **Pass**

Appendix D

Flow Measured Matrix Spike Recovery
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

	Pre Test	Post Test	Δ Flow %	% of Total Flow (avg)
Sample Gas Flow	3.30	3.33	0.9%	91.7%
Spike Gas Flow	0.30	0.30	0.0%	8.3%
Total Gas Flow	3.60	3.63	0.8%	
Spike % of Total Flow	8.3%	8.3%		
	≤10%	≤10%		

Pace Protocol Enhancement

Spike Constituent: Ethylene Oxide
Cylinder Concentration: 100 PPMv

Unspiked Average: 0
Target Concentration: 8.299 — 8.30 Spike Amt.

Unspiked Monitoring Results			Spiked Monitoring Results			Spike
Spectra File Name	**Date and Time**	**FTIR, PPMv**	**Spectra File Name**	**Date and Time**	**FTIR, PPMv**	**Recovery**
MKS3__0240.LAB	4/23/19 15:10	0	MKS3__0257.LAB	4/23/19 15:41	7.371	88.8%
MKS3__0241.LAB	4/23/19 15:13	0	MKS3__0259.LAB	4/23/19 15:41	7.546	90.9%
MKS3__0242.LAB	4/23/19 15:15	0	MKS3__0261.LAB	4/23/19 15:42	7.621	91.8%
MKS3__0243.LAB	4/23/19 15:17	0	MKS3__0263.LAB	4/23/19 15:42	7.666	92.4%
MKS3__0244.LAB	4/23/19 15:19	0	MKS3__0265.LAB	4/23/19 15:43	7.652	92.2%
MKS3__0245.LAB	4/23/19 15:21	0	MKS3__0267.LAB	4/23/19 15:43	7.797	94.0%
MKS3__0246.LAB	4/23/19 15:23	0	MKS3__0269.LAB	4/23/19 15:44	7.771	93.6%
MKS3__0247.LAB	4/23/19 15:25	0	MKS3__0271.LAB	4/23/19 15:45	7.728	93.1%
MKS3__0248.LAB	4/23/19 15:27	0	MKS3__0273.LAB	4/23/19 15:45	7.725	93.1%
MKS3__0249.LAB	4/23/19 15:29	0	MKS3__0275.LAB	4/23/19 15:46	7.763	93.5%
MKS3__0250.LAB	4/23/19 15:31	0	MKS3__0277.LAB	4/23/19 15:46	7.606	91.6%
MKS3__0251.LAB	4/23/19 15:33	0	MKS3__0279.LAB	4/23/19 15:47	7.786	93.8%
	Average Concentration	**0**		Average Concentration	**7.669**	**92.4%**

$$\%Rec = \frac{C_{Mtrx+Spk} - C_{Matrix}}{(\%F_{Matrix} \times C_{Matrix}) + (\%F_{Spike} \times C_{Spike}) - C_{Matrix}} \times 100$$

C_{Matrix} = Measured concentration of matrix gas.
C_{Spike} = Cylinder concentration of spike gas.
$C_{Mtrx+Spk}$ = Measured concentration of spiked matrix.
$\%F_{Matrix}$ = Percent of total flow for the matrix gas.
$\%F_{Spike}$ = Percent of total flow for the spike gas.

Acceptance Range 70%-130%

Acceptance Status **Pass**

FTIR Matrix Adjusted Quantitation Limits

Appendix D

FTIR Matrix Adjusted Quantitation Limits
Ethylene Oxide Abator Thermal Oxidizer Inlet
Test 1

System Identification:	MKS - Instrument MKS2	
Test Start Date:	April 23, 2019	
Empirical Cell Path Length:	4.88	meters
Sample Cell Temp:	310.2	°K

FTIR Test Analyte	Quantitation Region cm^{-1}	Quantitation Limit PPMv
Ethylene Oxide	2853-3200	0.75
Sulfur Hexafluoride	911-956	0.02
Ethylene	900-1000	0.25
Water Vapor	1257-1331	0.06

Matrix adjusted Quantitation Limits for FTIR instruments are determined with representative sample spectra.
The operator manually adjusts each constituents' absorbance features to be discernable over baseline noise.
The resulting baseline scaling factor is used by the instrument software to determine the specific Quantitation Limit.

Appendix D

FTIR Matrix Adjusted Quantitation Limits
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

System Identification:	MKS - Instrument MKS3	
Test Start Date:	April 23, 2019	
Empirical Cell Path Length:	5.11	meters
Sample Cell Temp:	309.7	°K

FTIR Test Analyte	Quantitation Region cm^{-1}	Quantitation Limit PPMv
Ethylene Oxide	776-970	0.75
Sulfur Hexafluoride	915-954	0.02
Ethylene	900-1000	0.25
Water Vapor	1257-1331	590

Matrix adjusted Quantitation Limits for FTIR instruments are determined with representative sample spectra.
The operator manually adjusts each constituents' absorbance features to be discernable over baseline noise.
The resulting baseline scaling factor is used by the instrument software to determine the specific Quantitation Limit.

Appendix D

FTIR Matrix Adjusted Quantitation Limits
Ethylene Oxide Abator Thermal Oxidizer Outlet
Test 1

System Identification:	MKS - Instrument MKS3	
Test Start Date:	April 23, 2019	
Empirical Cell Path Length:	5.11	meters
Sample Cell Temp:	309.7	°K

FTIR Test Analyte	Quantitation Region cm^{-1}	Quantitation Limit PPMv
Ethylene Oxide	776-970	0.75
Sulfur Hexafluoride	915-954	0.02
Ethylene	900-1000	0.25

Matrix adjusted Quantitation Limits for FTIR instruments are determined with representative sample spectra.
The operator manually adjusts each constituents' absorbance features to be discernable over baseline noise.
The resulting baseline scaling factor is used by the instrument software to determine the specific Quantitation Limit.

FTIR System Leak Check

System Identification: MKS - Instrument MKS2

Barometric Pressure: 0.949 Atmospheres
13.95 PSIA

System Volume:

	Length (ft)	Inner Dia. (in)	Volume (l)
Sample Line	25	0.25	0.241
Calibration Line	25	0.15	0.0869
Sample Cell	Nominal		0.200
		Total System Volume	**0.528**

Pretest Leak Check 4/23/2019 (Date Started)

	Positive Pressure				Negative Pressure		
	Time 24 Hour	Pressure PSIA	Pressure Atm.		Time 24 Hour	Pressure PSIA	Pressure Atm.
Initial Rdgs	7:41	17.68	1.203		7:34	10.61	0.7222
Final Rdgs	7:45	16.54	1.126		7:38	11.21	0.7631
Difference	4.2 (minutes)	1.1 (PSIA)	0.077 (Atmospheres)		4.2 (minutes)	0.60 (PSIA)	0.041 (Atmospheres)
	Leak Rate, % Vol/Min		1.9%	≤4%	Leak Rate, % Vol/Min		1.0%
	Leak Rate, ml/min		10	≤50 ml/min	Leak Rate, ml/min		5.4

Posttest Leak Check 4/23/2019 (Date Completed)

	Positive Pressure				Negative Pressure		
	Time 24 Hour	Pressure PSIA	Pressure Atm.		Time 24 Hour	Pressure PSIA	Pressure Atm.
Initial Rdgs	16:16	16.87	1.148		16:08	8.757	0.5959
Final Rdgs	16:21	16.01	1.089		16:13	9.177	0.6244
Difference	5.4 (minutes)	0.86 (PSIA)	0.059 (Atmospheres)		5.0 (minutes)	0.42 (PSIA)	0.029 (Atmospheres)
	Leak Rate, % Vol/Min		1.2%	≤4%	Leak Rate, %Vol/Min		0.6%
	Leak Rate, ml/min		6.1	≤50 ml/min	Leak Rate, ml/min		3.2

Pretest Leak Check Status **Pass**

Posttest Leak Check Status **Pass**

System Identification: MKS - Instrument MKS3

Barometric Pressure: 0.969 Atmospheres
14.24 PSIA

System Volume:

	Length (ft)	Inner Dia. (in)	Volume (l)
Sample Line	50	0.25	0.483
Calibration Line	50	0.15	0.174
Sample Cell	Nominal		0.200
		Total System Volume	**0.856**

Pretest Leak Check 4/23/2019 (Date Started)

	Positive Pressure				Negative Pressure		
	Time 24 Hour	Pressure PSIA	Pressure Atm.		Time 24 Hour	Pressure PSIA	Pressure Atm.
Initial Rdgs	7:00	17.74	1.207		6:48	3.328	0.2265
Final Rdgs	7:03	17.69	1.204		6:51	3.389	0.2306
Difference	3.1 (minutes)	0.049 (PSIA)	0.0033 (Atmospheres)		3.2 (minutes)	0.061 (PSIA)	0.0042 (Atmospheres)
	Leak Rate, % Vol/Min		0.1%	≤4%	Leak Rate, % Vol/Min		0.1%
	Leak Rate, ml/min		0.93	≤50 ml/min	Leak Rate, ml/min		1.2

Posttest Leak Check 4/23/2019 (Date Completed)

	Positive Pressure				Negative Pressure		
	Time 24 Hour	Pressure PSIA	Pressure Atm.		Time 24 Hour	Pressure PSIA	Pressure Atm.
Initial Rdgs	16:17	17.54	1.193		16:10	7.974	0.5426
Final Rdgs	16:22	17.44	1.187		16:15	8.068	0.5490
Difference	5.2 (minutes)	0.093 (PSIA)	0.0063 (Atmospheres)		5.0 (minutes)	0.094 (PSIA)	0.0064 (Atmospheres)
	Leak Rate, % Vol/Min		0.1%	≤4%	Leak Rate, %Vol/Min		0.1%
	Leak Rate, ml/min		1.1	≤50 ml/min	Leak Rate, ml/min		1.1

Pretest Leak Check Status **Pass**

Posttest Leak Check Status **Pass**

Appendix E

Source/Process/Plant Information

Process Operational Logs

DateTime	AttestETO_ABATE. InletTemp (F)	AttestETO_ABATE. OutletTemp (F)	4/23/2019 :Time
4/23/2019 9:00	358	341	9:00
4/23/2019 9:05	367	341	9:05
4/23/2019 9:10	360	341	9:10
4/23/2019 9:15	364	341	9:15
4/23/2019 9:20	366	340	9:20
4/23/2019 9:25	358	340	9:25
4/23/2019 9:30	366	341	9:30
4/23/2019 9:35	364	346	9:35
4/23/2019 9:40	359	347	9:40
4/23/2019 9:45	367	349	9:45
4/23/2019 9:50	360	358	9:50
4/23/2019 9:55	364	374	9:55
4/23/2019 10:00	365	391	10:00
4/23/2019 10:05	358	403	10:05
4/23/2019 10:10	367	402	10:10
4/23/2019 10:15	363	394	10:15
4/23/2019 10:20	360	384	10:20
4/23/2019 10:25	367	374	10:25
4/23/2019 10:30	360	366	10:30
4/23/2019 10:35	364	361	10:35
4/23/2019 10:40	367	356	10:40
4/23/2019 10:45	357	353	10:45
4/23/2019 10:50	366	351	10:50
4/23/2019 10:55	363	350	10:55
4/23/2019 11:00	361	349	11:00
4/23/2019 11:05	368	347	11:05
4/23/2019 11:10	361	345	11:10
4/23/2019 11:15	364	344	11:15
4/23/2019 11:20	367	344	11:20
4/23/2019 11:25	357	344	11:25
4/23/2019 11:30	366	344	11:30
4/23/2019 11:35	364	344	11:35
4/23/2019 11:40	359	343	11:40
4/23/2019 11:45	368	342	11:45
4/23/2019 11:50	361	346	11:50
4/23/2019 11:55	362	348	11:55
4/23/2019 12:00	366	348	12:00
4/23/2019 12:05	358	352	12:05
4/23/2019 12:10	367	364	12:10
4/23/2019 12:15	365	383	12:15
4/23/2019 12:20	359	401	12:20

DateTime	AttestETO_ABATE. InletTemp (F)	AttestETO_ABATE. OutletTemp (F)	4/23/2019 :Time
4/23/2019 12:25	367	409	12:25
4/23/2019 12:30	361	403	12:30
4/23/2019 12:35	364	393	12:35
4/23/2019 12:40	364	383	12:40
4/23/2019 12:45	359	373	12:45
4/23/2019 12:50	366	366	12:50
4/23/2019 12:55	360	362	12:55
4/23/2019 13:00	366	357	13:00
4/23/2019 13:05	365	354	13:05
4/23/2019 13:10	357	351	13:10
4/23/2019 13:15	368	350	13:15
4/23/2019 13:20	364	349	13:20
4/23/2019 13:25	358	346	13:25
4/23/2019 13:30	367	346	13:30
4/23/2019 13:35	363	345	13:35
4/23/2019 13:40	361	345	13:40
4/23/2019 13:45	367	345	13:45
4/23/2019 13:50	359	345	13:50
4/23/2019 13:55	366	346	13:55
4/23/2019 14:00	367	345	14:00
4/23/2019 14:05	359	344	14:05
4/23/2019 14:10	366	344	14:10
4/23/2019 14:15	367	344	14:15
4/23/2019 14:20	358	349	14:20
4/23/2019 14:25	367	351	14:25
4/23/2019 14:30	364	352	14:30
4/23/2019 14:35	359	358	14:35
4/23/2019 14:40	368	371	14:40
4/23/2019 14:45	365	391	14:45
4/23/2019 14:50	359	406	14:50
4/23/2019 14:55	368	410	14:55
4/23/2019 15:00	364	403	15:00
4/23/2019 15:05	358	393	15:05
4/23/2019 15:10	368	381	15:10
4/23/2019 15:15	365	373	15:15
4/23/2019 15:20	358	366	15:20
4/23/2019 15:25	367	362	15:25
4/23/2019 15:30	363	358	15:30
4/23/2019 15:35	360	355	15:35
4/23/2019 15:40	366	352	15:40
4/23/2019 15:45	361	351	15:45
4/23/2019 15:50	364	349	15:50
4/23/2019 15:55	368	348	15:55

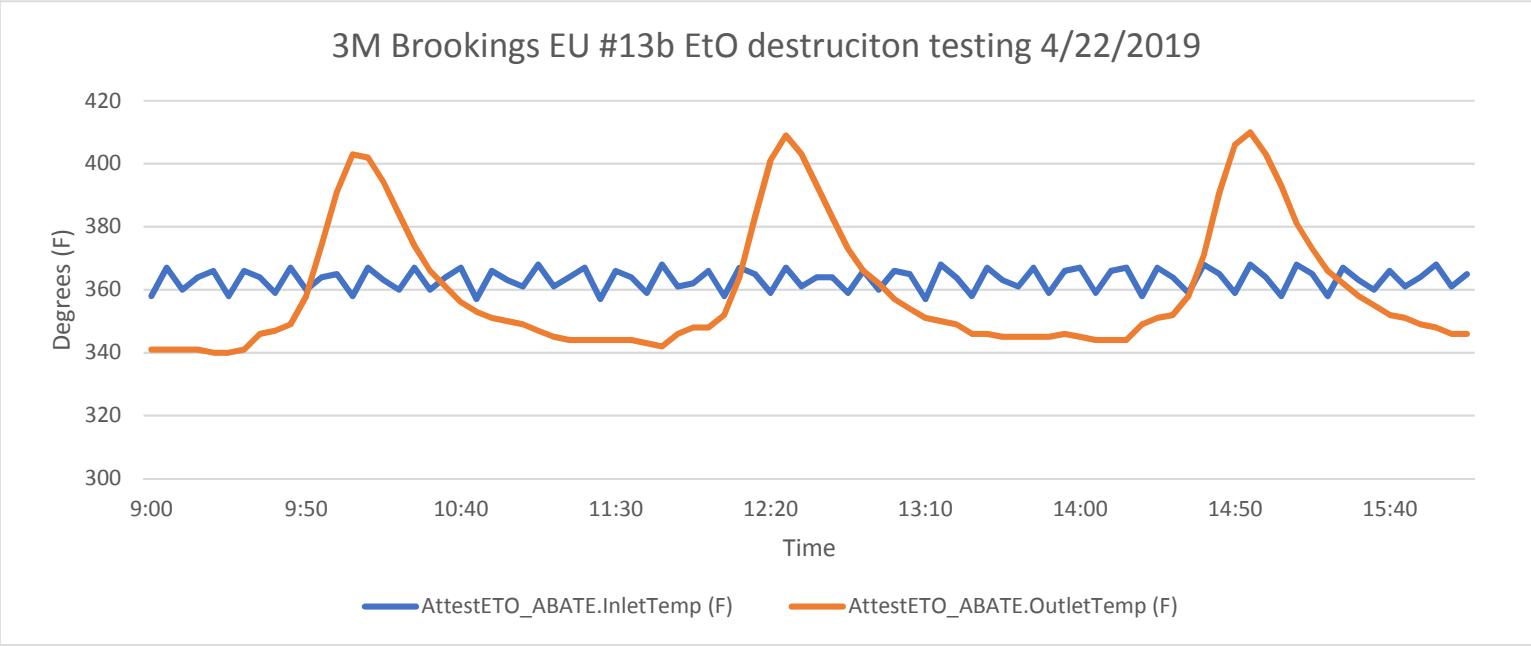
DateTime	AttestETO_ABATE. InletTemp (F)	AttestETO_ABATE. OutletTemp (F)	4/23/2019 :Time
4/23/2019 16:00	361	346	16:00
4/23/2019 16:05	365	346	16:05

Process Conditions:

Three(3) sterilizers dump of 100g canisters of

1 Ethylene Oxide at same time.

2 Catalyst bed INLET set point (F): 360



Appendix F

Test Protocol and Pretest Correspondence

Test Protocol Document

Pace Analytical Services, LLC
1700 Elm Street SE
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6388
www.pacelabs.com

Ethylene Oxide Emissions Testing Protocol

Plant Name: 3M Health Care
Protocol Date: January 25, 2019
Revision Date: No revisions to date
Testing Dates: April 23, 2019

Subject Facility:

3M Health Care
601 22nd Avenue S
Brookings, SD 57006

Regulatory Permit No.:
28.9901-06

Subject Emission Sources:
Ethylene Oxide Abator

Test Locations:
Thermal Oxidizer Inlet
Thermal Oxidizer Outlet

Client Test Coordinator:

Tim Gutzkow
3M Environmental Laboratory
Building 260-5N-17
St. Paul, MN 55144

Telephone No.: (651) 733-9776
E-mail Address: tgutzkow@mmm.com

Testing Firm Coordinator:

Brett Erickson
Pace Analytical Services, LLC
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Telephone No.: (612) 607-6432
Facsimile No.: (612) 607-6388
E-mail Address: brett.erickson@pacelabs.com

Table of Contents

Plant/Source Information

Subject Facility:	3M Health Care 601 22nd Avenue S Brookings, SD 57006
Plant Contact:	Paul Peterson
Company Affiliation:	3M Health Care
Office Address:	601 22nd Avenue S Brookings, SD 57006
Telephone Number:	(605) 696-1445
Facsimile Number:	-
E-mail Address:	p-peterson@mmm.com
Reason for Test:	40 CFR 63 Subpart O (Ethylene Oxide Emission Standards for Sterilization Facilities)

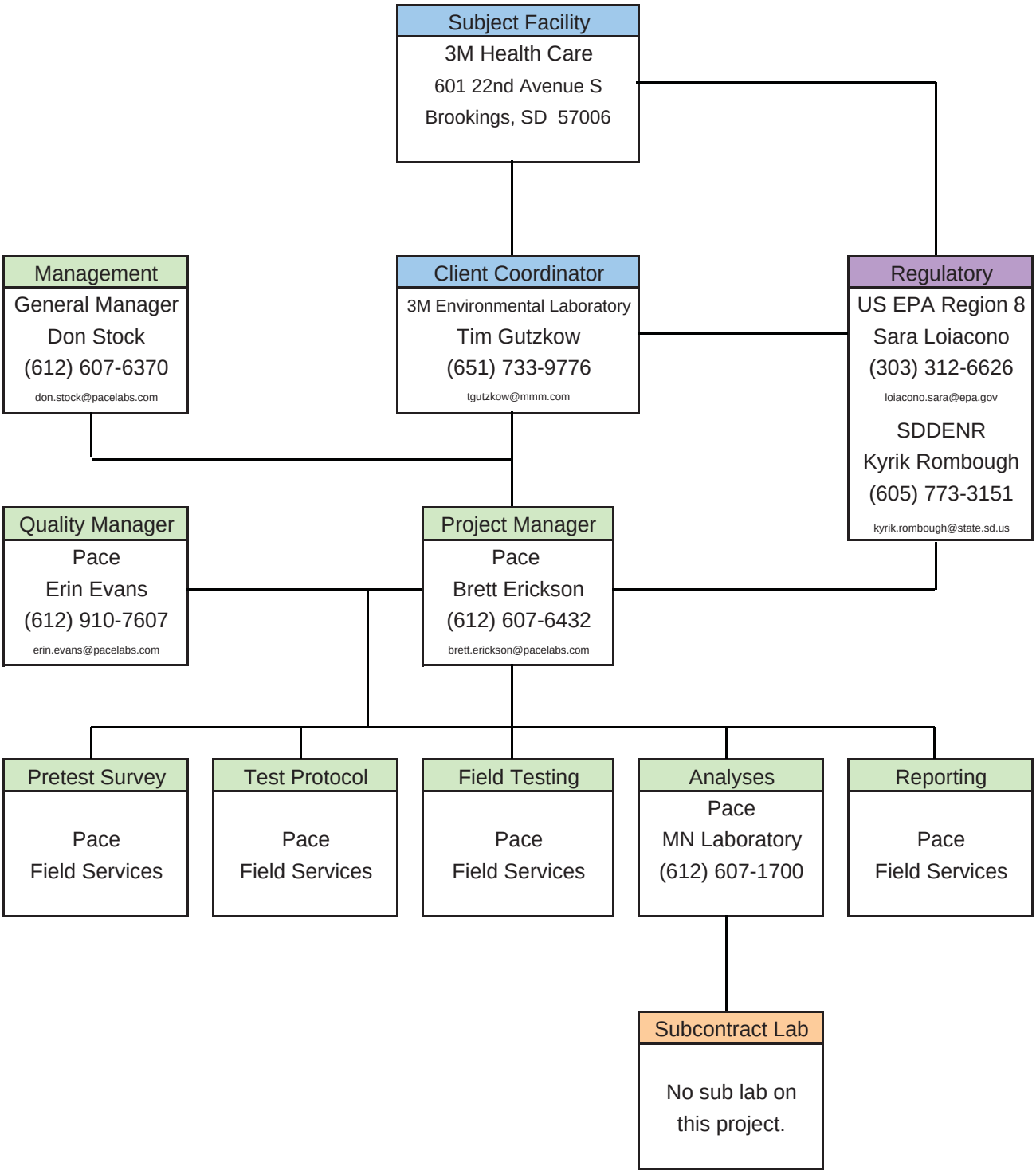
Testing Firm Information

Project Contact:	Brett Erickson
Testing Firm:	Pace Analytical Services, LLC
Office Location:	1700 Elm Street, Suite 200 Minneapolis, MN 55414
Telephone Number:	(612) 607-6432
Facsimile Number:	(612) 607-6388
E-mail Address	brett.erickson@pacelabs.com
Subcontractors:	No subcontractors to be used.

Regulatory Contact Information

Regulatory Agency:	US EPA Region 8	South Dakota DENR
Testing Contact:	Sara Loiacono	Kyrik Rombough
Office Location:	8ENF-AT 1595 Wynkoop Street Denver, CO 80202	Joe Foss Building 523 East Capital Pierre, SD 57501
Telephone Number:	(303) 312-6626	(605) 773-3151
Facsimile Number:	-	-
E-mail Address	loiacono.sara@epa.gov	kyrik.rombough@state.sd.us

Project Organization



Note: Chart based on anticipated participants at the time of protocol development and is subject to change.

Facility and Process Description

Target Operating Conditions: Single Condition at 90+% Capacity

The facility uses three (3) ethylene oxide sterilizers to conduct product assurance testing of medical appliance products manufactured at the site. Each sterilizers unit uses a small 100-gram canisters of ethylene oxide gas to conduct batch quality testing. Each sterilizer runs independent of each other and conducts gas exposure testing cycles using various amounts of ethylene oxide gas from the canister. The only time ethylene oxide gas is released from a sterilizer is at the completion of a test cycle, followed by flushing of the sterilizer chamber with fresh air. The three (3) sterilizers are all connected to a common manifold that transfers the gas to the catalytic oxidizer outside of the building. All the process piping is 2-inches in diameter or smaller and is constructed from stainless steel.

Testing Schedule

Testing is presently planned for the following schedule:

Monday	Tuesday	Wednesday	Thursday	Friday
4/22/2019	4/23/2019	4/24/2019	4/25/2019	4/26/2019
Travel / Set Up	Test CTO Efficiency			

The final test report will be submitted by 3M to the US EPA Region 8 within 60 days of the completion of testing. In cases where multiple sources are tested during a single mobilization, the last day of testing will dictate the start of the 60 days. All sources evaluated during a mobilization will be summarized in a single report.

Ethylene Oxide Abator, Catalytic Thermal Oxidizer Testing Requirements

Emissions Testing Constituents				
Source No.	**Source Identification**	**Regulated Constituents**	**Applicable Rules or Regulations**	**Emission Limits**
Unit 13b	Ethylene Oxide Abator, Catalytic Thermal Oxidizer	Ethylene Oxide	40 CFR 63 Subpart O (Ethylene Oxide Emissions Standards for Sterilization Facilities)	≥99.0% destruction efficiency

Process Monitoring Parameters			
Source No.	**Process Parameter**	**Monitoring Method**	**Target Range**
	Temperature	Thermocouple	360°F
	Ethylene Oxide Usage	Engineering Calculations	TBD

Emissions Testing Methods						
Parameter	**Test Method**	**No. of Runs**	**Length of Run**	**Sample Vol/Rate**	**Report Units**	**Detection Limit**
Locate Test Ports & Traverse Points	EPA Method 1 (details below)	1	NA	NA	NA	NA
Volumetric Airflow (Outlet)	EPA Method 2	3	NA	NA	ACFM SCFM DSCFM	4 Ft./Sec.
Volumetric Airflow (Inlet)	OTM 24	3	NA	NA	ACFM SCFM DSCFM	4 Ft./Sec.
Gas Composition	EPA Method 3 Ambient Provision	NA	NA	NA	NA	NA
Gas Composition	Modified EPA Method 3/3A	3	1 Hour	30 Liters	% v/v Mole. Wt. %EA	0.1% v/v
Moisture Content	EPA Method 4 Alternative, Wet/dry bulb temp[1]	3	NA	NA	% v/v Mole. Wt.	0.2% v/v
Ethylene Oxide	EPA Method 320 Gas phase FTIR	3	1 Hour or duration of batch	0.5 - 1 LPM	PPM v/v mg/dscm LB/HR	0.5 PPM v/v

Test Location Details: Test site details are not currently available. The test location will be verified on-site and documented in the final report.

Special Considerations: Testing will be conducted simultaneously on the Catalytic Thermal Oxidizer inlet and outlet.

[1]Moisture content will be measured by gas phase FTIR for both inlet and outlet. Outlet moisture content will be verified by wet/dry bulb measurements.

Test Report

A final test report will be compiled by Pace Analytical at the completion of testing. The report will be submitted to the client within 30 days of the last day of sampling. The client will be responsible for submitting report copies as required by regulatory agencies. An electronic copy of the test report will be delivered via e-mail. The final test report will include the following information:

- Name and location of emission facility.
- Identification of emission unit.
- Date of tests.
- Name and address of testing company.
- Certification of project information (client signatures also required).
- Reasons and constituents for test.
- Names of observers and witnesses
- Emission results expressed in the units of the emission limitation criteria.
- Process descriptions as provided by the client.
- Process rate information as provided by the client.
- Descriptions of maintenance activities as provided by the client.
- Discussions of problems or errors encountered.
- Sampling and analytical procedures.
- Analytical results of fuels or process samples as appropriate.
- Dimensioned drawing of sampling location.
- Copies of raw field data.
- Copies of laboratory analytical reports.
- Calculation equations.
- Sampling train calibration data
- Laboratory quality assurance information as appropriate
- Copy of this test plan and other pertinent pretest correspondence.

Safety Considerations

Safety is an important aspect of sampling programs, especially when test teams and observers are in unfamiliar plant surroundings. Plants are required to provide test ports, safe test platforms and access routes. The test firm is required to follow plant safety protocols and rules as well as their own safety program. Attention must be given to special considerations related to testing such as overhead work, solvent usage, compressed gases, flammable materials, open ports and electrical appliances. Observers and regulatory witnesses must comply with both plant and test firm safety protocols. Pace cannot provide PPE for visitors and observers. The following protocols and Personal Protection Equipment (PPE) will be required for this site.

Safety Requirements	Pace Protocol	Plant Protocol
No Smoking	X	X
Safety Shoes	X	X
Metatarsal Guards		
ESD Shoes or Strap		
Hard Hat	X	X
Safety Glasses	X	X
Full-Face Shield		
Chemical Resistant Gloves		
Abrasion Resistant Gloves	X	
Temperature Insulating Gloves	X	
Full Length Trousers (Waist to Ankle)	X	
Long-Sleeved Shirt		
Fire Retardant Clothing		
Chemical Resistant Suit/Clothing		
No Facial Hair		
Dust Respirator		
Half-Face Air Purifying Respirator		
Full-Face Air Purifying Respirator		
Self Contained Breathing Apparatus		
Supplied Air Respirator		
Plant Security Log In		X
Plant Safety Training		X
Plant Escort		X
Spark Permit/Protocols		X
Electronic Device Restrictions		X
Designated Break/Smoking Areas		X
Safety Climb System		
Fall Protection (Harness/Tie-off)		X

Attachments

Attachment 1	Test Location Schematics
Attachment 2	Abbreviations, Symbols, and Nomenclature
Attachment 3	Calculation Equations
Attachment 4	Test Method Summaries
Attachment 5	Quality Statement

Attachment 1
Test Location Schematics

Test site details are not currently available. The test location will be verified on-site and documented in the final report.

Attachment 2
Abbreviations, Symbols, and Nomenclature

“Hg	Inches of Mercury (pressure)
“WC	Inches Water Column (pressure)
°C	Degrees Centigrade or Celsius
°F	Degrees Fahrenheit
°K	Degrees Kelvin (absolute)
°R	Degrees Rankin (absolute)
% v/v	Percent by volume
% w/w	Percent by weight
ACFM	Actual Cubic Feet per Minute
AP-42	Compilation of Air Pollutant Emission Factors, Volume I, Stationary Point and Area Sources.
BACT	Best Available Control Technology
BH	Baghouse
BHP	Brake Horsepower
BTU	British Thermal Unit
c	Centimeter
c^3	Cubic Centimeter
cc	Cubic Centimeter
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CE	Control Equipment (in Reg. ID Nos.)
CE	Control Efficiency
CEM	Continuous Emissions Monitor
CEMS	Continuous Emissions Monitoring System
CF	Cubic Feet
CFR	Code of Federal Regulations
C_1	Carbon (as carbon)
CH_4	Methane
C_3H_8	Propane
cm	Cubic Meter
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DGS	Distiller’s Grains with Solubles
DDGS	Dry Distiller’s Grains with Solubles
DRE	Destruction/Reduction Efficiency
DSCF	Dry Standard Cubic Feet
DSCFM	Dry Standard Cubic Feet per Minute
dscm	Dry Standard Cubic Meter
dscmm	Dry Standard Cubic Meter per Minute
dsl	Dry Standard Liter
EPA	Environmental Protection Agency
EP	Emission Point
ESP	Electrostatic Precipitator
EU	Emission Unit
FID	Flame Ionization Detector
FGR	Flue Gas Recirculation
FPD	Flame Photometric Detector
FPM	Feet Per Minute
FPS	Feet Per Second
FR	Federal Register
FT or ft	Foot or Feet
FT^3	Cubic Feet
FTIR	Fourier Transform Infrared
g	Gram
GC	Gas Chromatograph(y)
GPD	Gallons Per Day
GPH	Gallons Per Hour
GR	Grains
H_2O	Water
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HAPs	Hazardous Air Pollutants
Hg	Mercury
HP	Horsepower
HR	Hour
In.	Inch or Inches
KLB	Thousand Pounds
kW	Kilowatt
kWH	Kilowatt Hour
l	liter
LB	Pound or Pounds
LDAR	Leak Detection and Repair
m	Meter
m^3	Cubic Meter
MACT	Maximum Achievable Control Technology
MC	Moisture Content
µg	Microgram
µl	Microliter
µm	Micrometer (micron)
mg	Milligram
MGAL	Thousand Gallons
Min.	Minute or Minutes
ml	Milliliter
mm	Millimeter
MMBTU	Million British Thermal Units
MMSCF	Million Standard Cubic Feet
MS	Mass Spectrometry
MSDS	Material Safety Data Sheet
mW	Megawatt
MW	Molecular Weight
N_2	Nitrogen
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides (quantified as NO_2)
NSPS	New Source Performance Standard
O_2	Oxygen
PEMS	Parametric (or Predictive) Emissions Monitoring System
PID	Photo Ionization Detector
PM	Particulate Matter

PM_{10}	Particulate Matter with an aerodynamic diameter equal to or less than 10 microns
PM-10	PM_{10}
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter equal to or less than 2.5 microns
PM-2.5	$PM_{2.5}$
PPB	Parts Per Billion (see variation below)
PPM	Parts Per Million
PPMv	Part Per Million by volume
PPMv-dry	Parts Per Million by volume, dry basis
PPMv-wet	Parts Per Million by volume, wet basis
PPMw	Parts Per Million by Weight (mg/l)
PSIA	Pounds per Square Inch, Absolute
PSIG	Pounds per Square Inch, Gauge
PTE	Permanent Total Enclosure
RA	Relative Accuracy
RATA	Relative Accuracy Test Audit
rH	Relative Humidity
RTO	Regenerative Thermal Oxidizer or Recuperative Thermal Oxidizer
SCF	Standard Cubic Feet
SCFM	Standard Cubic Feet per Minute
scm	Standard Cubic Meter
scmm	Standard Cubic Meter per Minute
Scr.	Scrubber
SIC	Standard Industrial Classification
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
Sq. Ft.	Square Feet
TCD	Thermal Conductivity Detector
TO	Thermal Oxidizer
TPD	Tons Per Day
TPH	Tons Per Hour
TPY	Tons per year
TRS	Total Reduced Sulfur
TSP	Total Suspended Particulate Matter
TTE	Temporary Total Enclosure
USEPA	United States Environmental Protection Agency
VHAP	Volatile Hazardous Air Pollutant
VOC	Volatile Organic Compound
VOCs	Volatile Organic Compounds
WC	Water Column
WDGS	Wet Distiller's Grains with Solubles

State Environmental Agency Acronyms

ADEM	Alabama Department of Environmental Management
ADEC	Alaska Department of Environmental Conservation
ADEQ	Arizona Department of Environmental Quality
ADEQ	Arkansas Department of Environmental Quality
CARB	California Air Resources Board
CDPHE	Colorado Department of Public Health & Environment
CDEP	Connecticut Department of Environmental Protection
DNREC	Delaware Natural Resources & Environmental Control
FDEP	Florida Department of Environmental Protection
GEPD	Georgia Environmental Protection Division
IDEQ	Idaho Department of Environmental Quality
IEPA	Illinois Environmental Protection Agency
IDNR	Iowa Department of Natural Resources
KDHE	Kansas Department of Health & Environment
KDEP	Kentucky Department for Environmental Protection
LDEQ	Louisiana Department of Environmental Quality
MDEP	Maine Department of Environmental Protection
MDE	Maryland Department of the Environment
MDEP	Massachusetts Department of Environmental Protection
MDEQ	Michigan Department of Environmental Quality
MPCA	Minnesota Pollution Control Agency
MDEQ	Mississippi Department of Environmental Quality
MDNR	Missouri Department of Natural Resources
MDEQ	Montana Department of Environmental Quality
NDEQ	Nebraska Department of Environmental Quality
NDEP	Nevada Division of Environmental Protection
NHDES	New Hampshire Department of Environmental Services
NJDEP	New Jersey Department of Environmental Protection
NMED	New Mexico Environment Department
NYSDEC	New York State Department of Environmental Conservation
NCDENR	North Carolina Department of Environment & Natural Resources
NDDH	North Dakota Department of Health
OEPA	Ohio Environmental Protection Agency
ODEQ	Oklahoma Department of Environmental Quality
ODEQ	Oregon Department of Environmental Quality
PDEP	Pennsylvania Department of Environmental Protection
RIDEM	Rhode Island Department of Environmental Management
SCDHEC	South Carolina Department of Health & Environmental Control
SDDENR	South Dakota Department of Environment & Natural Resources
TDEC	Tennessee Department of Environment & Conservation
TCEQ	Texas Commission on Environmental Quality
UDEQ	Utah Department of Environmental Quality
VANR	Vermont Agency of Natural Resources
VDEQ	Virginia Department of Environmental Quality
WSDNR	Washington State Department of Natural Resources
WVDEP	West Virginia Division of Environmental Protection
WDNR	Wisconsin Department of Natural Resources

Attachment 3
Calculation Equations

EPA Method 2 Calculations

Flue Gas Linear Velocity

$$V_s = 85.49 \times C_p \times \overline{\sqrt{\Delta P}} \times \sqrt{\frac{\overline{T_s}}{P_s \times M_s}}$$

Volumetric Flow Rates - ACFM, SCFM & DSCFM

$$Q = 60 \times v_s \times A$$

$$Q_s = Q \times \left(\frac{528}{T_s}\right) \times \left(\frac{P_s}{29.92}\right) = Q \times 17.647 \times \left(\frac{P_s}{T_s}\right)$$

$$Q_{sd} = Q_s \times (1 - B_{ws})$$

Mass Flow Rate of Wet Flue Gas

$$m_g = \frac{4.995 \times Q_{sd} \times G_d}{1 - B_{ws}}$$

Actual Gas Density

$$\rho = \frac{0.04585 \times P_s \times M_s}{\overline{T_s}}$$

Where:

A	=	Cross-sectional area of duct at sample point (sq. ft.).
B_{ws}	=	Water vapor in gas stream (proportion by volume).
C_p	=	Pitot tube calibration coefficient.
G_d	=	Flue gas specific gravity relative to air, dimensionless.
m_g	=	Mass flow rate of wet flue gas (LB/HR).
M_s	=	Molecular weight of wet flue gas (LB/LB-mole).
P_s	=	Absolute gas pressure of duct (Inches Hg).
ΔP	=	Velocity pressure measured by pitot tube (Inches WC).
Q	=	Actual flue gas volumetric flow rate (ACFM).
Q_s	=	Volumetric gas flow at standard conditions (SCFM).
Q_{sd}	=	Dry standard volumetric gas flow rate (DSCFM).
T_s	=	Flue gas temperature (°R).
V_s	=	Flue gas linear velocity (feet per second).
ρ	=	Actual flue gas density (LB/CF).

EPA Method 3 Calculations

Dry Molecular Weight of Flue Gas

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times (\%N_2 + \%CO))$$

Wet Molecular Weight of Flue Gas

$$M_s = M_d \times (1 - B_{ws}) + (18 \times B_{ws})$$

Percent Excess Air

$$\%EA = 100 \times \left(\frac{\%O_2 - (0.05 \times \%CO)}{(0.264 \times \%N_2) - \%O_2 + (0.5 \times \%CO)} \right)$$

Fuel F-factor (for comparison)

$$F_o = \frac{20.9 - \%O_2}{\%CO_2}$$

Where:

B_{ws}	=	Water vapor in gas stream (proportion by volume).
%CO	=	Carbon monoxide in gas stream (percent).
$\%CO_2$	=	Carbon dioxide in gas stream (percent).
%EA	=	Excess air for combustion (percent).
F_o	=	Fuel F-factor for results comparison.
M_d	=	Molecular weight of dry flue gas (LB/LB-mole).
M_s	=	Molecular weight of wet flue gas (LB/LB-mole).
$\%N_2$	=	Nitrogen in gas stream (percent).
$\%O_2$	=	Oxygen in gas stream (percent).

Psychrometric Moisture Content

Saturated Water Vapor Pressure

VP_s = Value indexed from Vapor Pressure of Water Table (29.92" Hg)

Source Gas Water Vapor Pressure

$VP_a = VP_s - (0.000367 \times P_s \times (T_{db} - T_{wb}) \times (1+((T_{wb}-32) \div 1571)))$

Moisture Content

$MC\% = 100 \times VP_a \div P_s$

Where:

$MC\%$ = Moisture content of stack gas, percent by volume.
P_s = Absolute pressure of stack gas, inches Hg.
T_{db} = Dry bulb temperature measurement, °F.
T_{wb} = Wet bulb temperature measurement, °F.
VP_a = Vapor pressure of stack gas, inches Hg.
VP_s = Saturated vapor pressure at wet bulb temperature and 29.92 inches Hg.

VAPOR PRESSURE OF WATER ("Hg)										
	0	1	2	3	4	5	6	7	8	9
0	0.0376	0.0398	0.0417	0.0441	0.0463	0.0489	0.0517	0.0541	0.0571	0.0598
10	0.0631	0.0660	0.0696	0.0728	0.0768	0.0810	0.0846	0.0892	0.0932	0.0982
20	0.1025	0.1080	0.1127	0.1186	0.1248	0.1302	0.1370	0.1429	0.1502	0.1567
30	0.1647	0.1716	0.1803	0.1878	0.1955	0.2035	0.2118	0.2203	0.2292	0.2383
40	0.2478	0.2576	0.2677	0.2782	0.2891	0.3004	0.3120	0.3240	0.3364	0.3493
50	0.3626	0.3764	0.3906	0.4052	0.4203	0.4359	0.4520	0.4686	0.4858	0.5035
60	0.5218	0.5407	0.5601	0.5802	0.6009	0.6222	0.6442	0.6669	0.6903	0.7144
70	0.7392	0.7648	0.7912	0.8183	0.8462	0.8750	0.9046	0.9352	0.9666	0.9989
80	1.032	1.066	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.610	1.660	1.712	1.765	1.819	1.875
100	1.932	1.992	2.052	2.114	2.178	2.243	2.310	2.379	2.449	2.521
110	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
120	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.289	4.406
130	4.525	4.647	4.772	4.900	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.190	6.350	6.513	6.680	6.850	7.024	7.202	7.384
150	7.569	7.759	7.952	8.150	8.351	8.557	8.767	8.981	9.200	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.20	12.48	12.77	13.07	13.37	13.67	13.98	14.30	14.62	14.96
180	15.29	15.63	15.98	16.34	16.70	17.07	17.44	17.82	18.20	18.61
190	19.01	19.42	19.84	20.27	20.70	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26.00	26.53	27.07	27.62	28.18
210	28.75	29.33	29.92	30.52	31.13	31.75	32.38	33.02	33.67	34.33
220	35.00	35.68	36.37	37.07	37.78	38.50	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.14	49.03	49.93
240	50.84	51.76	52.70	53.65	54.62	55.60	56.60	57.61	58.63	59.67
250	60.72	61.79	62.88	63.98	65.10	66.23	67.38	68.54	69.72	70.92
260	72.13	74.36	74.61	75.88	77.16	78.46	79.78	81.11	82.46	83.83
270	85.22	86.63	88.06	89.51	90.97	92.45	93.96	95.49	97.03	98.61
280	100.2	101.8	103.4	105.0	106.7	108.4	110.1	111.8	113.6	115.4
290	117.2	119.0	120.8	122.7	124.6	126.5	128.4	130.4	132.4	134.4
300	136.4	138.5	140.6	142.7	144.8	147.0	149.2	151.4	153.6	155.9
310	158.2	160.5	162.8	165.2	167.6	170.0	172.5	175.0	177.5	180.0
320	182.6	185.2	187.8	190.4	193.1	195.8	198.5	201.3	204.1	206.9
330	209.8	212.7	215.6	218.6	221.3	224.6	227.7	230.8	233.9	237.1
340	240.3	243.5	246.8	250.1	253.4	256.7	260.1	263.6	267.1	270.6
350	274.1	277.7	281.3	284.9	288.6	292.3	296.1	299.9	303.8	307.7
360	311.6	315.5	319.5	323.5	327.6	331.7	335.9	340.1	344.4	348.7
370	353.0	357.4	361.8	366.2	370.7	375.2	379.8	384.4	389.1	393.8
380	398.6	403.4	408.2	413.1	418.1	423.1	428.1	433.1	438.2	443.4
390	446.6	453.9	459.2	464.6	470.0	475.5	481.0	486.6	492.2	497.9
400	503.6	509.3	515.1	521.0	526.9	532.9	538.9	545.0	551.1	557.3

Control Efficiency Calculations

Capture Efficiency of Volatile Organic Compounds

$$E_C = \frac{MR_{VOC_{In}}}{MR_{VOC_{Rls}}} \times 100$$

Destruction/Reduction Efficiency of Volatile Organic Compounds

$$E_{DR} = \frac{MR_{VOC_{In}} - \mathrm{MR}_{\mathrm{VOC_{Out}}}}{MR_{VOC_{In}}} \times 100$$

Control Efficiency of Volatile Organic Compounds

$$E_T = \frac{E_C \times E_{DR}}{100}$$

Where:

E_C = Capture Efficiency, percentage of VOC captured by exhaust versus VOC released based on carbon (percent).

E_{DR} = Destruction/Removal Efficiency of pollution control device (percent).

E_T = Total control or reduction efficiency based capture and destruction/removal efficiencies (percent).

$MR_{VOC_{Rls}}$ = Mass Rate of VOC released from process based on VOC usage and volatile carbon analyses of formulations (LB/HR_{carbon}).

$MR_{VOC_{In}}$ = Mass Rate of VOC measured at pollution control device inlet (LB/HR_{carbon}).

$MR_{VOC_{Out}}$ = Mass Rate of VOC measured at pollution control device outlet (LB/HR_{carbon}).

EPA Method 320 Quantitative Analyses

Absorbance

$$A = \log_{10}(1/T) = -\log_{10}T$$

Where:

A	=	Absorbance of compound.
$\log_{10}$	=	Logarithm to the base 10.
$(1/T)$	=	Reciprocal of the transmittance.

Beer's Law

$$A_v = a_i b c_i$$

Where:

A_v	=	Absorbance of the Ith component at the given frequency, *v*.
a_i	=	Absorption coefficient of the Ith component at the frequency, *v.*
b	=	FTIR calculated cell path length in meters.
c_i	=	Concentration of the Ith compound in the sample at frequency, *v.*

FTIR Spectral Analysis

$$PPMv = \left((SF \bullet Sample°K \bullet (LibraryPPM * m / Library°K)) / CellPathLength,m\right)$$

Where:

$PPMv$	=	Compound Concentration, parts per million by volume.
SF	=	Compound subtracted scale factor (Spectral difference versus library reference standard).
$Sample°K$	=	Temperature of sample gas in degrees Kelvin.
$LibraryPPM * m$	=	Reference library standard concentration in parts per million - meters.
$Library°K$	=	Temperature of reference standard gas in degrees Kelvin.
$CellPathLength,m$	=	FTIR calculated cell path length in meters.

Parameter	**Delivery**	**Recovery**
Date of Run	1/29/16	1/29/16
Time of Run	900-1000	900-1000
Sample Duration (Minutes)	60	60

Tracer Gas Flow, LPM	Pre	Post	Average
LPM	10.36	10.16	10.26
DSCFM			0.362

Constituent Concentration, PPMv - Dry		
Sulfur Hexafluoride	50,000	6.67

Dilution Factor = Injected concentration / Recovered concentration = 50,000 / 6.67 = 7500.314

Volumetric Flow Calculation

DF x Tracer Gas Flow,DSCFM = Total Gas Flow, DSCFM

7500.314 x 0.362 = 2,717.578

Total Gas Flow, DSCFM - Tracer Gas Flow, DSCFM = Flue Gas Flow, DSCFM

2,717.578 - 0.362 = 2717.215

Note: This method only allows calculation of DSCFM. Moisture content would be required to calculate SCFM.

Attachment 4
Method Summaries

EPA Method 1 specifies test location acceptability criteria and defines the minimum number of traverse points for representative sampling. Linear measurements from upstream and downstream flow disturbances and the duct equivalent diameter are compared and the distances related to number of diameters. A flow disturbance can be defined as anything that changes or upsets the direction of flow within the duct including bends, dampers, fans, shape or size transitions, and open flames. Method 1 stipulates that test ports should be located at least eight diameters downstream and two diameters upstream of any flow disturbance. The minimum acceptable criteria are two diameters downstream and 0.5 diameters upstream of flow disturbances. The test location must also be free of cyclonic or multidirectional flow. Once the distances have been determined, the values are used to select the minimum number of traverse points for representative sampling. Shorter distances require a greater number of traverse points. The test site configuration and measurement details are documented on EPA Method 1 Field Data Sheet.

Pace FSD conducts the method as written with no routine deviations.
Project situational deviations are documented at the time of the test.

EPA Method 2 defines procedures used to measure linear velocity and volumetric flow rate of a confined gas stream. Using traverse points determined by EPA Method 1, multiple differential pressure measurements (pitot impact opening versus static pressure) are made using a pitot tube and differential pressure gauge. The individual measurements are averaged and combined with the gas density to calculate the average gas velocity. The velocity and duct cross-sectional area are used to calculate the volumetric flow rate. The volumetric flow rate is expressed as actual cubic feet per minute (ACFM), standard cubic feet per minute (SCFM), and dry standard cubic feet per minute (DSCFM). The technician maintains comprehensive test records on EPA Method 2 Field Data Sheet. Details of the equipment used to measure gas velocity include:

Pitot Tube:	S-Type
Differential Pressure Gauge:	Oil or Electronic Digital Manometer
Temperature Device:	Type K Thermocouple
Barometer Type:	Electronic Digital Barometer
Gas Density Determination:	EPA Method 3
Gas Moisture Determination:	EPA Method 4

Method Defined Quality Control:

- Pitot tubes are verified on an annual basis.
- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.
- Electronic barometers are verified for accuracy and calibrated on a semi-annual basis. Aneroid barometers are not used.

- Electronic Digital Manometers (EDMs) are verified for accuracy and calibrated on a semi-annual basis. EDMs are operationally confirmed and leak checked for each run.
- Sampling system leak-checks are performed before and after each run and prior to any component change during a run.

Pace FSD conducts the method as written with no routine deviations.
Project situational deviations are documented at the time of the test.

EPA Method 3 Ambient Provision allows the use of published or ambient gas concentrations (dry molecular weight of 28.96 LB/LB-mole) in cases where the source gas is free of combustion components. Ambient gas concentrations result in a dry molecular weight of 28.96 (29.0) LB/LB-mole.

Gas Constituent	% v/v	Molecular Weight	LB/LB -mole
Nitrogen, N_2	78.08	28.01	21.87
Oxygen, O_2	20.95	32	6.70
Argon, Ar	0.93	39.95	0.37
Carbon Dioxide, CO_2	0.038	44.01	0.02
Sum of Gas Constituents			28.96

Modified EPA Method 3/3A defines procedures to quantify carbon dioxide (CO_2) and oxygen (O_2) concentrations from stationary combustion sources. An integrated gas sample is collected simultaneously with other emissions testing. Sample gases are extracted from an emission stream at a constant rate over the course of a test period equal to other test constituents. A Tedlar™, aluminized Mylar™, or other inert material bag contains the collected gas sample prior to sample analyses. Instrumental gas analyzers compliant to EPA Method 3A quantify the CO_2 and O_2 concentrations. Three point instrument calibrations (zero, mid, and high span) are performed to certify the instruments for gas analyses. The technician maintains comprehensive test records on EPA Method 3 and Gas Analysis Field Data Sheets. Equipment used for measuring gas composition includes:

Filter Material:	Glass-fiber Filter or equivalent
Moisture removal:	Condenser and/or sorbent
Bag Material:	Tedlar™ or Aluminized Mylar™ or equivalent
Gas Analyzer:	Non-dispersive Infrared Detector (CO_2) Paramagnetic Detector (O_2)
Calibration Gases:	EPA Protocol 1

Method Defined Quality Control:

- Sampling bag leak check.

Pace FSD conducts the method as written with the following routine sampling deviation:

In the field, the gas sample is analyzed within two hours of collection using a portable O_2 detector. At a later time, potentially outside of the eight hour hold period, the gas sample is re-analyzed using an EPA Method 3A (Orsat) gas analyzer to quantify CO_2 and O_2 concentrations.

The preliminary analysis result from the portable O_2 detector is used to validate the Orsat results. The results are acceptable when the O_2 result from the field and the O_2 result from the lab differ by ≤ 0.3%.

Project situational deviations are documented at the time of the test.

Psychrometric Moisture Determination (EPA Method 4 Alternative Provision) defines procedures to measure the moisture content of emissions gas streams from stationary sources. Wet bulb/dry bulb temperature measurements of the gas stream are recorded. Psychrometric charts and vapor pressure of water tables are used to calculate the moisture content of the gas streams.

Method Defined Quality Control:

- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.

Pace FSD conducts the method as written with no routine deviations.
Project situational deviations are documented at the time of the test.

EPA Method 320 defines procedures to speciate and quantify gas-phase compounds using extractive Fourier Transform Infrared Spectrometry (FTIR). A probe and sample line of inert materials draw a sample gas stream from the source and continuously deliver it to a nickel-cadmium sample cell at a constant rate. Sample interface materials and application of heat depend on the constituents of interest. Primary calibration gases are EPA Protocol 1 ethylene in nitrogen and target constituent gas calibrations occur as appropriate. Method 320 - Appendix D presents calibration trials, matrix spiking, detection limit derivations and other quality procedures. Infrared energy directed through the cell and returned to an interferometer classifies spectral separations based on the sample gas composition. Collected mid-range infrared interferograms are converted to absorbance spectra then compared to existing library reference standards to identify and quantify gas constituents. A diaphragm or rotary vane pump downstream of the cell moves the gas sample through the interface components and safely to vent. Elevated interface temperatures inhibit condensation of moisture and volatile constituents when appropriate. In some instances, elevated concentrations of water and carbon dioxide can spectrally interfere with compound(s) of interest. Water and carbon dioxide spectra are specifically or empirically developed for a sample matrix. Standardized subtraction methods are applied to sample spectra to alleviate potential spectral interferences. Sample cell pressure is monitored and maintained within ± 10 in. WC of atmospheric. The FTIR operator completes a Gas Monitoring (FTIR) Field Data Sheet as a

comprehensive record of testing parameters. Details of FTIR instrumentation are shown below.

Sample Flow Rate:	~3-6 LPM
Probe Material:	Teflon™
Transfer Lines:	Teflon™
Sample Cells:	5.11 M (Outlet), 35 cm or 2 cm (Inlet)
Cell Windows:	Zinc Selenide
Sample Interface Temp:	150°C (Outlet), 35°C (Inlet)
Instrument:	MKS MultiGas 2030 Gas Phase FTIR
Detector:	Mercury Cadmium Telluride (MCT)
Wave Number Range:	650 – 3500 cm^{-1}
Scans/Result:	16/64/128
Resolution:	0.5 cm^{-1}
Gain:	1

Other Test Method 24 (OTM 24) - Tracer gas protocol for the determination of volumetric flow rate is performed at the test location in conjunction with the ethylene oxide testing to determine the volumetric airflow. SF_6 is used as the tracer gas and a FTIR is used as the detector. Injection of the tracer gas into the purge air line is documented using a flow testing instrument (DC-Lite DryCal.). The concentration of SF_6 in the certified gas standard cylinder is known and documented. The airflow is calculated using a mass balance and the concentration of SF_6 at the location as measured using FTIR (EPA Method 320), the flow rate that the tracer is injected into the room, and the concentration of SF_6 in the certified gas standard.

Reference Standards. Pace implements a comprehensive program to verify and validate reference standards to further enhance and support method standards. Primary reference standards are directly comparable to a reference base. The National Institute of Standards and Technology (NIST) maintains primary reference materials or very closely traceable secondary standards. These materials are then used to certify secondary or transfer standards for use in quality management programs. Secondary reference standards are calibrated with primary standards using a high precision comparator. Materials that have a documented path to the primary standard are often referred to as traceable to NIST or NIST traceable. Where commercially and feasibly available, Pace uses primary reference standards to perform calibrations and verifications. In other cases, Pace maintains traceable secondary reference standards. Primary and secondary reference standards are used to calibrate and verify equipment and materials. Pace reference standards are calibrated by external vendors that have a formal, registered quality system. Calibrations are performed with equipment and materials that are traceable to NIST.

Quality Controls (not defined in test methods):

- Sampling/Recovery Reagents are Reagent Grade or better.
- Reference Temperature Simulator is calibrated annually.
- Reference Pressure Transducer is calibrated annually.
- Reference DryCal airflow meter is calibrated annually.

- Mercury Barometer is a primary reference standard.
- Liquid Manometers are primary reference standards.
- Angle Blocks, Gauge Blocks, and Measuring Rods are verified every five years.
- Angle Gauges are verified each day of use.
- Calipers are verified annually.
- Stainless steel reference weights are verified every five years.
- Analytical balances are calibrated annually and verified at each use.
- Field balances are calibrated annually and verified at each use.

Attachment 5
Quality Statement

Quality Management System. To produce data that is complete, representative, and of known precision and accuracy, Pace Analytical Field Services Division has designed and implemented a rigorous and innovative quality management system. The system was initially based on the USEPA Quality Assurance Handbook for Air Pollution Measurement Systems and continually developed as procedural complexities and standards progressed. The Field Services Division Quality Management System (Pace FSD QMS) is now accredited by the American Association of Laboratory Accreditation (A2LA) to comply with three national accreditation standards:

- ASTM D7036 - Standard Practice for Competence of Air Emission Testing Bodies (AETB).
- ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
- The NELAC Institute - General Requirements for Field Sampling and Measurement Organizations (FSMO)

The Pace FSD QMS includes:

- Quality Programs
  - Ethics policy and training.
  - Corrective Action and Preventative Action (CAPA).
  - Continuous Process Improvement.
  - Documented Demonstrations of Capability.
  - Internal and third party proficiency testing.
  - Qualified Individual program (QI)
  - Internal and external audits.
  - Annual management reviews.
- Documentation and Traceability
  - High quality traceable standards and reagents.
  - Reagent tracking and management system.
  - Use of matrix spikes, duplicate analysis, internal standards, and blanks.
  - Validated workbooks for data collection and results reporting.
  - Electronic quality, training, and safety documents available in-field.
  - Sample security and preservation procedures.
  - Chain of custody maintained from sample collection through laboratory analysis.
- Equipment Calibration
  - Full time staff dedicated to equipment maintenance and calibration.

All equipment and instruments are calibrated by trained personnel on a frequency that meets or exceeds method requirements. Documentation of the Pace Analytical Quality Assurance Program will be available on-site.